CHAPTER 4
CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

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This chapter discusses anticipated direct and indirect impacts of the Proposed Action, two alternatives, and the No Action Alternative for the SOAPA. In addition, irreversible and irretrievable commitment of resources, and residual adverse effects are described. The Proposed Action is described in Chapter 2 and it basically involves developing expanded mining facilities on 1,392 acres to continue mining on the existing 7,960 acre South Operations Area Project. The impact analyses in this document will address only the incremental effects that could occur and not the total effect from both the existing and approved operations and proposed SOAPA. Cumulative impact are addressed in Chapter 5. A comparison of impacts between the Proposed Action and alternatives is summarized at the end of this chapter.

The two alternatives considered are: (1) the Proposed Action with backfilling of the Mac pit; and (2) the Proposed Action with modified waste rock disposal facilities.

Potential mitigation and monitoring measures developed in response to anticipated impacts are discussed for each resource. All actions listed as mitigation measures have been developed by BLM and are not part of Newmont's Proposed Action. These measures could be required by BLM or other regulatory agencies as a condition or stipulation of approval and authorization of the SOAPA.

Irreversible and irretrievable commitment of resources and residual effects that would likely occur as a result of the Proposed Action or alternatives are discussed for each resource. Continued operation, closure, and reclamation of the SOAPA would result in an irreversible or irretrievable commitment of various resources. These resources would either be consumed, committed, or lost during and after the life of the project. Nonrenewable resources, such as minerals in the ore, would be irreversibly committed during ore-processing operations. Irretrievable commitments are those that are lost for a period of time. Residual effects would be those impacts remaining after implementation of mitigation. Cumulative effects (discussed in Chapter 5) result from incremental effects of the action when added to other past, present, and reasonably foreseeable future actions.

GEOLOGY AND MINERALS

Direct impacts of the Proposed Action and alternatives (except the No Action Alternative) on geologic and mineral resources would be limited to excavation and relocation of waste rock and processed ore and the removal of gold. Backfilling of the Mac pit would reduce the likelihood of future recovery of known gold reserves. These direct impacts would not be mitigated.

Indirect impacts would involve potential discharge of acidic water from waste rock disposal facilities and refractory ore stockpiles. Ongoing and proposed waste encapsulation and monitoring programs would be expected to adequately prevent these potential indirect impacts. Potential instability of waste rock disposal facilities, tailing storage facilities, and pit slopes would be

prevented through proper design and construction.

Predicting sinkhole development from mining activities requires consideration of site-specific geology, hydrology, topographic information, and climate. Sinkhole development is most likely in areas where carbonate rocks are at or sufficiently near the ground surface. These conditions would allow for the collapse of subsurface cavities, or piping (washing out of granular material) of the overlying soils into those cavities. Either of these processes would result in enough displacement of the cover materials to impact the surface topography. If the cavities occur within deep carbonate deposits overlain by thick consolidated material, a collapse would be unlikely to impact the surface topography (BLM, 2000b).

A large area that could potentially be susceptible to sinkhole development was identified north of the South Operations area. This area contains few buildings, major roads, or other infrastructure. Critical mine-related facilities such as waste rock storage facilities, heap leach pads, and mill and tailings facilities are not located within this area. A segment of a power line associated with the Gold Quarry Mine occurs within the area. Other non-mine-related features of note located within the area includes a 2.5-mile segment of Maggie Creek and a 2.5-mile segment of Highway 766. **Figure 4-0** illustrates this area of potential sinkhole development in relation to the predicted 10-foot drawdown contour.

It is important to note that information on the depth to carbonate rock and thickness of cover materials is based on limited subsurface information. The site specific risk of sinkhole development will depend, in part, on site conditions including depth to carbonate rocks, mineralogical and hydrological characteristics of the carbonate rock, size of new or pre-existing voids in the carbonate rock, properties of the overlying materials, and hydrologic changes induced by the cumulative mine dewatering and water management activities (BLM, 2000b).

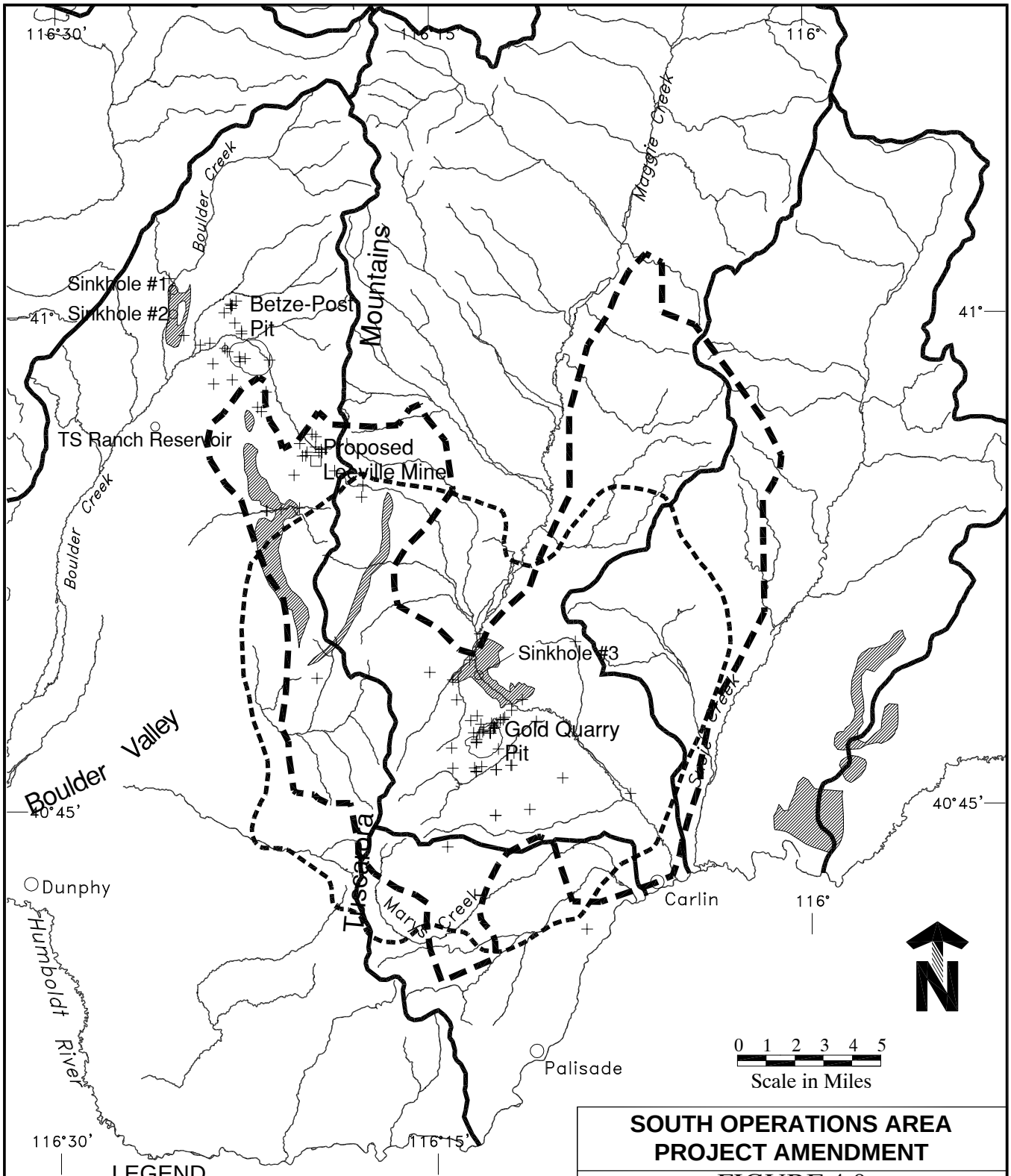
Direct and Indirect Impacts

Proposed Action

Direct impacts of the Proposed Action on geologic and mineral resources would include relocation of approximately 408 million tons of waste rock and 118 million tons of processed ore to various waste rock disposal facilities, tailing storage facilities, and leach pads. In addition, several million ounces of gold would be extracted from the geologic resource.

Indirect impacts of the Proposed Action could arise from placement of potentially acid-producing material in waste rock disposal areas and refractory ore stockpiles. Rain and snowmelt infiltrating through waste rock and ore piles could potentially cause an acidic discharge through contact with these materials.

The SOAPA would produce potentially acid-generating waste rock. The Gold Quarry North and South WRDFs are designed to accommodate potential acid generating rock. Potential impacts from acid rock drainage are expected to be low because of construction techniques, the capture of any drainage, monitoring, depth to groundwater (Chapter 2, South Operations Area Waste Rock Disposal Facilities, and Resource Monitoring), and low precipitation in the area.



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-0

AREAS POTENTIALLY SUSCEPTIBLE TO SINKHOLE DEVELOPMENT IN RELATION TO DRAWDOWN CONTOURS

MINE AREA: SOUTH AREA	
DATE: 8/18/00	ACAD FILE: Fig4-0.DWG
SCALE: AS NOTED	DRAWN BY: ML

Waste rock is sampled at least daily. Grab samples, taken from each waste polygon which is outlined and determined according to statistical analyses, arecomposited and the weighted average is measured biannually. The samples are analyzed for heavy metals and acid base accounting.

The issue of acid production was evaluated in the original EIS (BLM, 1993). The SOAPA calls for an increase in mining of refractory ore. Therefore, the relative proportion of acid-generating rock resulting from the Proposed Action may be higher. However, Newmont proposes to use the same procedures for handling potentially acid-producing waste rock and refractory ore stockpiles as those analyzed by the BLM (1993).

Encapsulation of acid-producing waste rock within the middle of waste-rock piles under the provisions of the Refractory Ore Stockpile and Waste Rock Dump Design, Construction and Monitoring Plan is expected to prevent any impacts of acid production (Newmont, 1997b, Appendix B). Waste rock would be monitored for waste rock chemistry in order to properly route the materials to an encapsulation site. Additional information about encapsulation was provided in the section on Existing Operations in Chapter 2.

Refractory ore stockpiles may be a source of acid drainage over the life of the operation. These stockpiles are not expected to exist after project closure and, therefore, have a relatively short-term potential for producing acid drainage. The following factors are expected to adequately mitigate or detect potential formation and discharge of acid water: (1) acid-neutralizing soils and relatively deep water table; (2) construction of compacted clay pads beneath stockpiles; (3) temporary closure of stockpiles older than two years; and (4) Newmont's monitoring program.

Alternatives

Direct and indirect impacts on geologic and mineral resources for the two action alternatives would be essentially the same as those resulting from the Proposed Action, with the exception of burying mineralized gold resources in the Mac pit. Known gold resources of up to 70,000 to 80,000 ounces of gold may be lost by implementation of this alternative. The backfilling alternative would also eliminate the pit walls as a study area for geology and paleontology.

No Action Alternative

The No Action Alternative eliminates proposed future expansion and avoids potential direct and indirect impacts of the Proposed Action and other action alternatives. It also eliminates the recovery of several million ounces of gold from the geologic resource.

Potential Mitigation and Monitoring

Newmont would continue its program of waste rock sampling in order to monitor potentially acid generating rock. The sampling and handling of waste rock to prevent acid rock drainage is described in the Refractory Ore Stockpile and Waste Rock Dump Design, Construction and Management Plan (Newmont 1997b, Appendix B).

Irreversible and Irretrievable Commitment of Resources

Approximately 526 million tons of material would be removed from the Gold Quarry pit

and stored on the surface. Several million ounces of gold would be removed from the geologic resource.

Residual Effects

No unmitigated residual effects to the geologic resource would be expected.

PALEONTOLOGICAL RESOURCES

It is possible that expansion of the Gold Quarry pit into the Carlin Formation could expose subsurface paleontological deposits, but this eventuality cannot be confidently predicted through available data or further surface inspections.

Direct and Indirect Impacts

Proposed Action

Impacts on fossils would be direct, caused by physical disturbance. Because fossils are usually buried, there is no way of confirming their location or distribution until excavation occurs. In terms of potential in-situ fossil materials, most of the actions would involve disturbance of unconsolidated soil levels that are unlikely to yield significant materials. The principal disturbance of potential fossil bearing deposits would be the deepening and expansion of the Gold Quarry pit. Although the potential for unique or important fossil material in the mine area appears low, mine crews and supervisory personnel would be made aware of the potential for encountering fossils, and should notify the BLM authorized officer if any vertebrate fossils are encountered.

Alternatives

Impacts on paleontological resources resulting from either of the two alternatives would be the same as those discussed under the Proposed Action. Impacts would be limited to areas of development. Backfilling the Mac pit in Alternative 1 would eliminate the pit walls as a study area. Pit walls can be regarded as study areas but the safety issue of access would have to be addressed.

No Action Alternative

The No Action Alternative would eliminate potential impacts on paleontological resources in areas of proposed development. Closure and abandonment of the South Operations Area would involve soil replacement, regrading, recontouring, and other reclamation activities that may cover or uncover previously unknown fossils, depending on the location and type of disturbance.

Potential Mitigation and Monitoring

When fossils are discovered during mine development or operational activities, steps would be taken to identify them and preserve them, when appropriate. Newmont would contact the BLM to determine the steps necessary for recovery of fossils.

Irreversible and Irretrievable Commitment of Resources

An irreversible and irretrievable commitment of paleontological resources would occur as a result of the Proposed Action if fossils are encountered. However, additional information about the resource would be obtained and an assessment of the significance would be made.

Residual Effects

No residual effects on paleontological resources are anticipated as a result of the Proposed Action or alternatives.

AIR RESOURCES

Air quality in the project area would be slightly affected by the SOAPA. The only effect of the amendment would be a slight, short-term increase in particulates and diesel exhaust emitted during construction activities and from wind-blown fugitive dust from a 17.5 percent increase in disturbed areas, assuming no concurrent reclamation. However, the small increase in particulate emissions would not cause violations of National or State of Nevada Ambient Air Quality Standards.

Direct and Indirect Impacts

Proposed Action

Under the Proposed Action, no expansion of Mill 5, the oxide ore treatment plant, or Mill 6, the refractory ore treatment plant, would occur. Therefore, the modeled ambient air concentrations described in Chapter 3 would not increase. **All criteria pollutant emissions except 24-hour PM_{10} (NO_x, SO_2, CO) from these facilities are currently less than 10 percent of the levels allowed by the National and State of Nevada Ambient Air Quality Standards.**

PM_{10} in the form of fugitive dust emissions are directly related to the amount of material processed and the amount of disturbed land exposed to wind-blown erosion. The process rate would not increase under the Proposed Action. However, the amount of disturbed land would increase by 17.5 percent (7,960 acres presently to 9,352 acres with the amendment). Therefore, fugitive dust emissions **during expanded operations** could cause a maximum increase of ambient air concentrations by 17.5 percent to 105 $\mu g/m^3$ for a 24-hour period and 27 $\mu g/m^3$ for the annual average. This value would be 70 percent of the 24-hour and 54 percent of the average annual allowable Federal and State of Nevada Ambient Air Quality Standards (150 $\mu g/m^3$ and 50 $\mu g/m^3$, respectively). The amendment would not cause any exceedance of ambient air quality standards.

Mercury is a common element in the rocks that are being mined at SOAP and is to be mined at SOAPA. Mercury is a persistent, bioaccumulative element. Mercury emissions to the air are associated with dust particles from traffic, and ore and waste rock handling. Fugitive emissions of mercury are estimated at 29 pounds per year. Emissions of mercury from the roaster stack and other point sources are estimated at 50 pounds per year. The two sources of mercury are emitted at a rate of approximately 0.01 pounds per hour. EPA considers air emissions of 1,850 pounds per year of mercury to be a significant level for mercury ore-processing facilities (40 CFR 61.52). Mercury in the air ultimately is deposited on soils or water where it can then enter the food chain. Since mercury is a persistent, bioaccumulative element, it also finds its way into humans. Sampling in soils and water in the Maggie Creek Basin has not detected a change in background mercury levels.

There are 12 other hazardous air pollutants that would be emitted from SOAPA besides

mercury (presented in the air quality section of Chapter 3). Most of the hazardous air pollutants are heavy metal compounds that ultimately fall out of the air column and impact soils and waters. However, sampling for these hazardous air pollutants shows no change above background levels. Heavy metals contribute to health effects on organs and nervous systems as well as the normal functioning of these systems. There are no permit limitations on the emission levels of hazardous air pollutants for the metal mining industry, but mining facilities must attempt to minimize hazardous air pollutant emissions as much as possible. Newmont has state-of-the-art controls on its major point sources which serve to control the majority of emissions to air, but since the metal compounds are associated with the ore and waste rock, the handling of these materials contribute to fugitive emissions. Newmont waters all roads, all working areas, and all transfer points on conveyors to try and control fugitive emissions.

The monitoring of PM_{10} showed elevated **levels** during 1994 **which were attributed to wildfires**. PM_{10} levels would be **expected to remain similar to existing levels, or be slightly elevated. C**onstruction and enlargement of the Property Leach Pad 2, Non-Property Leach Pad, Refractory Leach Pad**, and relocation of the James Creek tailing facility would likely change the local pattern of fugitive dust but is not expected to increase the existing levels by more than 17.5 percent.**

Alternatives

Air quality impacts under either alternative would be similar to the Proposed Action. Haul road configurations would be changed under Alternative 1 and fugitive particulates would be generated in locations north and west of the Gold Quarry pit. Haul miles would likely be greater, resulting from a longer haul upgrade to the Mac pit. Haul trucks exiting the pit at the southwest corner would travel more than 8,200 feet to reach the Mac pit versus 3,000 feet to reach the South or James Creek WRDFs. Haul trucks exiting the pit on the east side might have to travel 12,000 feet to reach the Mac pit versus less than 6,000 feet to reach the North WRDF. Therefore, diesel combustion emissions would also be greater than under the Proposed Action.

No Action Alternative

Under the No Action Alternative, mining operations would cease around 2001. The air quality would return to pre-mining levels after reclamation of disturbed areas is complete.

Potential Mitigation and Monitoring

No mitigation measures are proposed, as Newmont's application of Best Management Practices (Handbook of Best Management Practices, Nevada State Conservation Commission, 1994) are sufficient to meet state and federal standards.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of air resources would result from the Proposed Action or alternatives.

Residual Effects

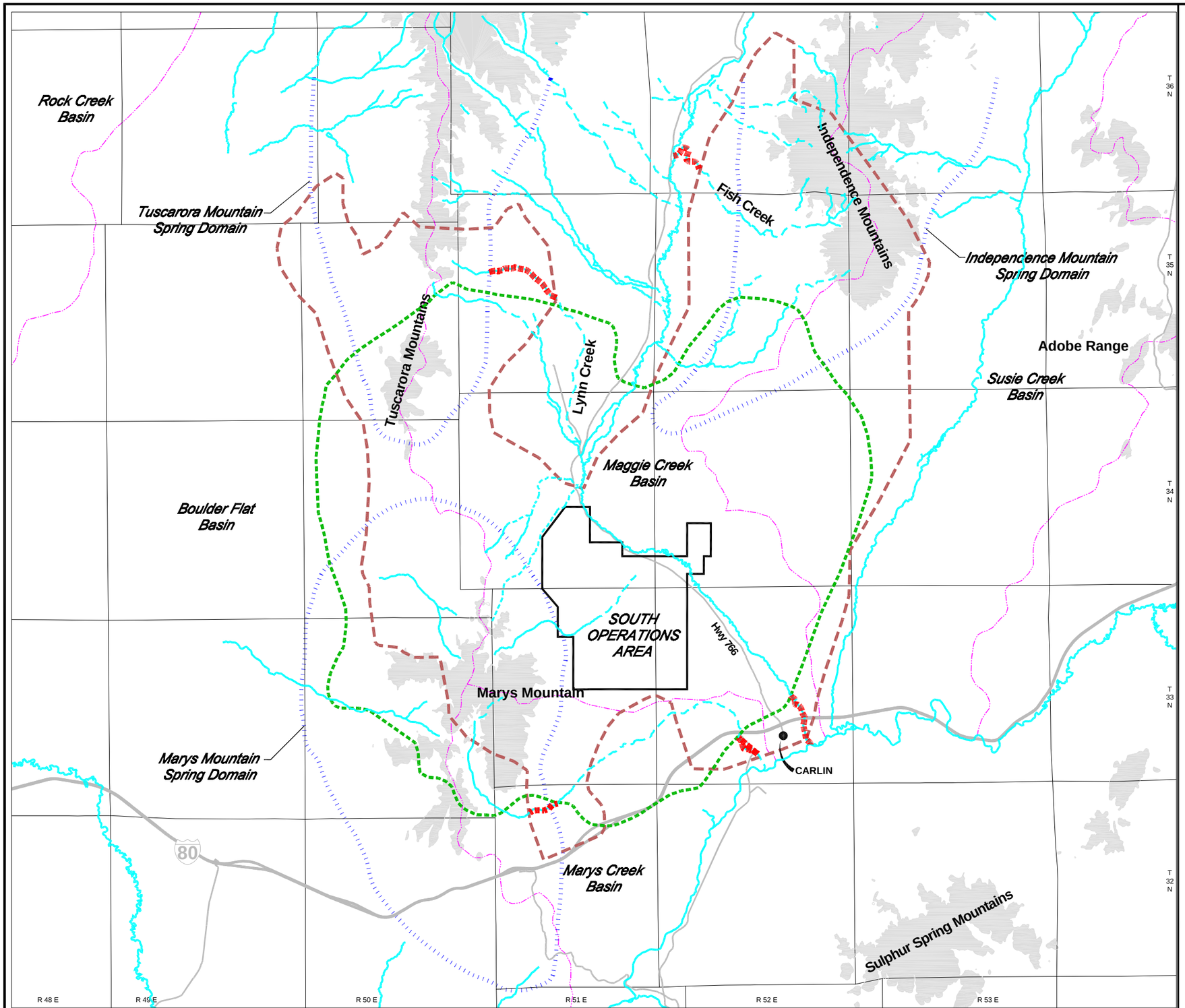
No residual effects to the air quality would be anticipated as a result of the Proposed Action or alternatives. Following mine closure and reclamation, air quality would be expected to return to pre-mining conditions.

WATER RESOURCES

The SOAPA would require continued dewatering as the mine pit deepens and ultimately extends approximately 1,805 feet deep below the pre-mining surface, 350 feet deeper than previously analyzed. Declining groundwater levels surrounding the mine pit would create a cone of depression that would affect flows of some springs, seeps, and streams in the study area. When dewatering ceases at the end of year 2011, the Gold Quarry pit would begin to fill with groundwater; water depth would approach 95 percent of the observed pre-mining water table elevation after 60 years (HCI, 1999). **Maximum drawdown would be expected around 2011 and f**lows from impacted springs, seeps, and streams would begin to recover **as the water table approaches pre-mining levels.**

Most springs in the mountains are supplied by perched aquifers (not hydrologically connected to deeper aquifers) and therefore are not likely to be affected by mine dewatering. Based on the extent of groundwater drawdown predicted by a numerical groundwater model (HCI, 1999) up to 5 spring and seep sites could be impacted through reduced or lost flows in the vicinity of the Gold Quarry pit beyond the 25 sites analyzed in 1993. Some of these sites include more than one spring or seep located in a group. The Carlin "Cold" Spring system used by the town of Carlin as a water supply source is predicted to have a significant reduction in baseflow. Some water wells also may be impacted by the cone of depression; however, only two existing private wells are predicted to be completely dewatered. Groundwater level drawdown would extend asymptotically and result in an irregular pattern, in plan view, **extending** three to 1**8** miles around the mine pit **area**. Maximum impacts on springs, seeps, and groundwater levels would occur roughly between years 2000 to 2050 (HCI, 1999). After nearly 150 years, groundwater is anticipated to recover to within approximately 8 feet of pre-mining levels.

Excess water from the dewatering system would continue to be discharged to Maggie Creek under the Proposed Action. Changes in Maggie Creek water temperature are minimized through the use of a cooling tower for discharge water; hence, Maggie Creek water temperature would not affect Humboldt River water temperature. Stream erosion has been minimized through the use of bank stabilization measures. During the dewatering period, maximum discharge in lower Maggie Creek could be as high as 65 cfs (29,000 gpm). This is a decrease from flows of 104 cfs (46,400 gpm) analyzed in the original EIS (BLM, 1993). No impacts on surface water quality are allowed by Newmont's current discharge permit. Currently discharged untreated water does not exceed National Pollutant Discharge Elimination System



Source: BLM, 1993.

LEGEND

- 1999 Predicted 10ft Drawdown Contour
- 1993 Predicted 10ft Drawdown Contour
- Hydrologic Basins
- Stream Reaches Potentially Impacted
- Perennial Streams
- Intermittent Streams
- Spring Domain
- Mountain Ranges

N

0 1 2 3 4 5 6

Scale in Miles

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-1
PREDICTED IMPACTED STREAM REACHES

MINE AREA: SOUTH AREA	
DATE: 8/1/00	ACAD FILE: Fig4-1.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

(NPDES) water quality standards. An existing, but currently unused water treatment facility would be employed, if necessary, to meet the standards. The treatment facility was designed to treat 20,000 gpm, and treatment for arsenic was a major design feature.

The cone of depression is predicted to reduce baseflows in some streams in the project area during and/or after the dewatering period. Affected streams would include **lower Fish, middle** and lower Marys Creek (primarily the Carlin "Cold" Spring), lower Maggie Creek, and upper Lynn Creek. **Figure 4-1** shows the stream reaches within the 10-foot drawdown contour. Baseflow in the Humboldt River between Carlin and Palisade could be reduced by as much as 5 cfs after dewatering ceases. (The 1993 analysis indicated a reduction of 19 cfs.) Lowest average monthly baseflows priorto mining were in September and October with rates of 26 and 46 cfs, respectively. These reductions in surface water baseflow would be most significant during the first 10 to 20 years after cessation of mining. It is predicted to take up to several decades for baseflow in some streams to completely recover to pre-mining conditions; the Humboldt River may have baseflow permanently lowered by 1.5 cfs.

The Gold Quarry pit is predicted to eventually fill with groundwater to an ultimate depth of approximately 1,370 feet. The pit lake surface is predicted to be near 5,091 feet elevation above mean sea level. The groundwater level near the pit lake is predicted to recover to approximately 8 feet below the pre-mining water table after around 150 years, and to take around 60 years to reach 95 percent of this level, or 38 feet below the pre-mining water table (HCI, 1999). Most of the pit lake would form during the first 10 to 20 years after the dewatering system is discontinued. A study utilizing laboratory tests and computer models was conducted to predict the quality of water that would collect in the mine pit (Geomega, 1997b). Ultimate quality of mine pit water is predicted to be similar to or better than existing groundwater in the ore zone because of: (1) carbonate rock in the pit that prevents development of acidic conditions; (2) removal of the mineralized zone and associated sulfides and groundwater during mining; and (3) adsorption and deposition of trace metals on ferric hydroxides.

Direct and Indirect Impacts

Direct and indirect impacts on groundwater and surface water resources would result from the SOAPA. These impacts would be associated primarily with the dewatering activities necessary to allow continued mining below the water table.

Few additional direct and indirect impacts associated with the Proposed Action beyond the impacts approved by the BLM (1993) are expected. Some impacts could occur as a result of new or expanded mine facilities. Disturbed areas such as waste rock disposal facilities, ore stockpiles, leach pads, mine pit, pipeline corridors, roads, and ancillary facilities would have increased erosion Waste rock and ore stockpiles also would have potential for generating acidic drainage.

In 1993, the BLM analyzed potential dewatering effects based on computer modeling that predicted a 10-foot drawdown contour line that encompassed an area of 152,000 acres. The computer modeling conducted for the SOAPA predicted a 10-foot drawdown contour line that is 17 percent larger than the 1993 contour. The incremental

area for potential drawdown is approximately 26,000 acres. Significantly, the predicted drawdown contour encompasses very small increments of stream reaches, springs, riparian habitat, and grazing areas, compared to those analyzed in 1993. Additionally, the predicted drawdown contour line in 1999 has some major contour changes that have the effect of reducing the miles of streams and acres of riparian areas that are predicted to be affected by water drawdown in the incrementally expanded study area. As a result, this EIS will analyze only the incremental effects. Cumulative effects are analyzed separately in Chapter 5.

Proposed Action

Dewatering System

Groundwater is currently pumped from wells at the South Operations Area for purposes of keeping the mine dry, milling, processing, environmental controls, and other related activities. Dewatering of the mine pit would be extended until the end of year 2011, to allow continued mining laterally and at depth.

The rate of groundwater pumping would continue at flow rates lower than those analyzed in the original EIS (BLM, 1993). After 2011, groundwater withdrawal would be significantly reduced to meet continued ore processing and reclamation demands for approximately five additional years. Predicted groundwater withdrawal rates until the end of year 2011 are presented in **Figure 4-2**.

A hydrogeologic numerical model was developed to predict necessary dewatering rates at the Gold Quarry Mine (HCI, 1992, 1996, 1999). A dewatering rate of up to 42,000 gpm was analyzed in 1993 (BLM, 1993). Dewatering pumping rates of up to 25,000 gpm are expected during the life of the proposed project (HCI, 1999) (**Figure 4-2**). Currently, the average annual pumping rates are less than 20,000 gpm (Newmont, 1999c). Following the completion of the Gold Quarry mining operations, pumping rates would continue for approximately five years at a rate of 2,500 gpm to support process operations.

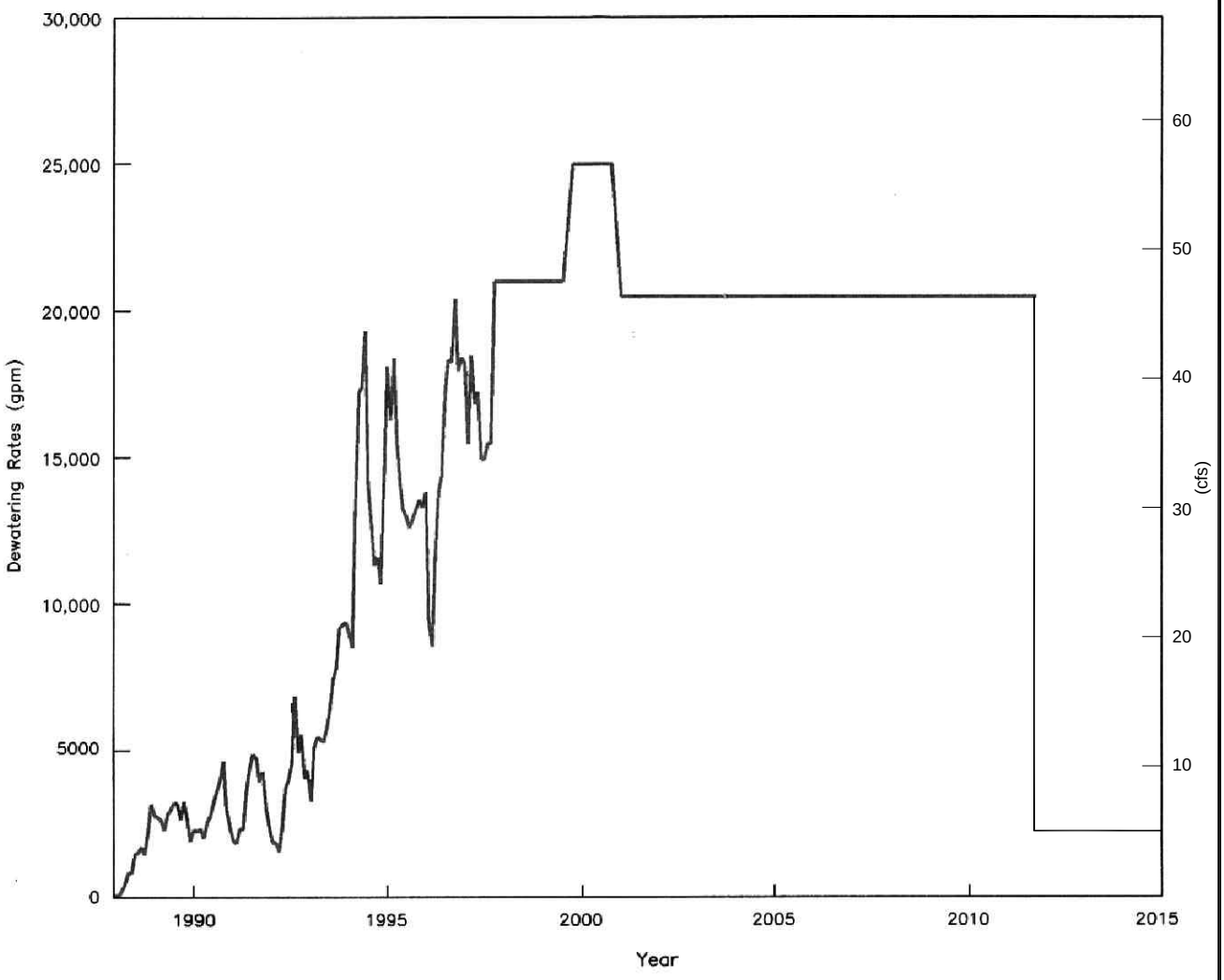
Excess water from the dewatering system is currently used in mine operations, ore processing, road watering, work area watering, irrigation and is also discharged in Maggie Creek below Maggie Creek Canyon and would continue to be discharged for the additional mining period. During periods of high natural flow in Maggie Creek, excess mine water would continue to be stored temporarily in the Maggie Creek Ranch Reservoir.

Water Treatment System

A water treatment system was installed. However, the treatment plant was used for only one month, because arsenic (metal of primary concern) levels of the untreated water never exceeded the NPDES water quality standards (Pettit, 1998). Water quality would continue to be analyzed regularly. It is not expected that the NPDES water quality standards would be exceeded. However, should this occur, the water treatment plant would be put into operation.

Water Storage Reservoir

The existing Maggie Creek Ranch Reservoir and its operation were discussed in the original EIS (BLM, 1993) and is not a part of the SOAPA proposal. However, its operation is still affected by the SOAPA. The existing



Total Produced 1988-1998 161,000 acre-feet.
Total Predicted 1999-2011 400,000 acre-feet.

Source: HCI, 1999.

SOUTH OPERATIONS AREA PROJECT ADMENDMENT

FIGURE 4-2
PAST (ACTUAL) AND PREDICTED DEWATERING RATES FOR THE GOLD QUARRY MINE

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SCALE: NTS	DRAWN BY: EC, MODIFIED BY DS

Maggie Creek Ranch Reservoir has a capacity of 6,000 acre-feet compared to its capacity in 1993 of 2,700 acre-feet. The reservoir allows Newmont to withhold discharge to Maggie Creek during high-flow periods. Under its current operation the reservoir has never been completely filled. Any flood waters that exceed the capacity of the reservoir would be discharged to the unnamed tributary of Maggie Creek through the spillway. Water storage in Maggie Creek Ranch Reservoir would continue during the extended period of the mining operations. The reservoir would be used for ranch purposes post-mining.

Stored water in the reservoir is released to Maggie Creek by pipeline during the remainder of the year in order to make storage available for the following spring runoff period. During 1997, discharge was routed to Maggie Creek Ranch Reservoir twice in the first quarter during high flows in Maggie Creek. Approximately 1,350 acre-feet were in temporary storage at the end of the first quarter. This water was released during the second quarter. Approximately 525 acre-feet remained in temporary storage at the end of the second quarter. Water management would be similar under the Proposed Action. A maximum rate of about 10 cfs (4,500 gpm) of water is released from the reservoir if discharge from the full reservoir is distributed evenly during a 10-month period each year. A discharge structure containing a concrete stilling basin, and channel constructed with riprap, transfers water to the Maggie Creek channel. Releases are also made from the reservoir to meet irrigation demand on land adjacent to Maggie Creek during the growing season. Between 1,800 and 4,900 acre feet per year (1,100 to 3,000 gpm per day over 90 days) were used for this irrigation diversion annually in the period from 1994 to 1998, and similar annual amounts are expected to be used for irrigation in the future.

Seepage from the Maggie Creek Ranch Reservoir recharges groundwater in the underlying alluvium and Carlin Formation, causing some additional groundwater baseflow in lower Maggie Creek Basin.

Groundwater Flow Model

Numerical modeling of groundwater flow systems in the South Operations study area has been conducted in conjunction with Newmont by HCI (1992, 1996, and 1999). The model produces a prediction of the amount of groundwater that must be removed from the mine pit area, providing the basis for designing an effective dewatering system. In addition, the model predicts the extent of groundwater drawdown, or cone of depression, that would result from dewatering. Impacts on baseflows in the modeled area also are predicted. Finally, the model predicts the rate at which groundwater would flow into the mine pit after dewatering operations cease.

The model uses the computer program MINEDW to predict three-dimensional groundwater flow with an unconfined water surface using the finite-element method (HCI, 1992). This program was developed to solve problems related to mine dewatering and has special attributes (e.g., simulation of an excavation and calculation of the seepage face on the pit wall) for that purpose. Geologic, hydrologic, and climatological data were incorporated into the conceptual hydrogeologic model describing groundwater and surface water flow in the study area. BLM has reviewed and approved the application of the model to the Gold Quarry Mine (Sandia National Laboratories, 1998). The model was calibrated to known conditions, such as recharge values, water level elevations, stream baseflows, and hydraulic testing results (drawdown and recovery tests). The BLM

subjected the model calibration to an intensive review in late 1998 and early 1999. Model calibration is an ongoing activity and will continue in the future to refine predictive capabilities and improve efficiency of dewatering operations.

As with all groundwater models, MINEDW is a predictive tool, the effectiveness of which is a function of the hydrogeologic data utilized. Newmont has developed a comprehensive hydrologic database in the mine pit area as well as the surrounding region to support the model. Supplemental USGS regional information was incorporated into the numerical model in areas, such as boundary regions, that lack detailed hydrogeologic data. Predictions of groundwater drawdown and baseflow impacts must be considered with the understanding that actual conditions may deviate from the predictions. For purposes of this EIS, the predicted maximum extent of the 10-foot drawdown contour line was selected to represent the general area of hydrogeologic impact. It was selected because it approximately represents the limit of seasonal variation in the water table. The 10-foot drawdown contour was created by selecting the maximum extent of drawdown in any modeled year; thus, the drawdown contour does not represent the actual drawdown in one specific year, but the maximum extent of the 10-foot drawdown during and after mining. Specific results of the model are discussed below.

Impacts on Groundwater Levels

Dewatering operations at the Gold Quarry Mine would result in development of a cone of depression in the water table surrounding the mine pit. Extent of drawdown for the water table using the maximum 10-foot drawdown contour is shown in **Figure 4-3**. For comparison, the 10-foot drawdown contour as previously analyzed by the BLM (1993) is also shown.

The groundwater drawdown would be greatest close to the mine pit. Drawdown **c**ould also occur outside of the 10-foot contour line shown in **Figure 4-3**; however, water level changes in these areas would be difficult to distinguish from seasonal or long-term variations in natural conditions.

Groundwater drawdown in the upper water table aquifer would extend beyond the time of active dewatering of the mine. This drawdown would be a function of water moving from the water table aquifer into the lower aquifers due to dewatering in the underlying aquifers. Drawdowns from mining activities through December 1998 are up to 600 feet in the lower, siltstone and carbonate bedrock aquifer (Figure 4-4). No drawdown is apparent in the Carlin Formation water table aquifer through December 1998 (Figure 4-4). The model (HCI, 1999) 10-foot drawdown contour for the water table aquifer extends from 6 to 15 miles from the Gold Quarry pit (Figure 4-3). The modeled 10-foot drawdown contour represents drawdown only in the water table aquifer, which occurs mainly in the Carlin Formation.

Total volume of groundwater removed by the South Operations Area dewatering system through December 1998 was 161,000 acre-feet (Newmont, 1999c). Additional volume removed through 2011 would be approximately 400,000 acre-feet (HCI, 1999). In 1993, the volume through 2001 was estimated at 500,000 acre-feet (BLM, 1993).

After year 2011, the cone of depression would diminish as the pit fills with water and groundwater levels rise toward pre-mining conditions. Initial rate of water recovery in the mine pit would be relatively rapid, followed by a decreasing rate of pit infilling as hydraulic gradients into the pit decline. The pit lake would recover to approximately 95 percent or within 38 feet of the pre-mining water table approximately 60 years after dewatering ceases (HCI, 1999). The numerical model predicts that water in the mine pit would ultimately recover to less than 8 feet below pre-mining levels within 150 years of completing dewatering operations, or around 2162 (HCI, 1999). A graph of the projected lake filling is presented later in this chapter in **Figure 4-15.** Complete recovery to pre-mining levels of the water table in the study area is not expected due to evaporation from the pit lake. Equilibrium may take approximately 150 years to reach as natural recharge and discharge of groundwater in the basin come to a new balance with the pit lake evaporation.

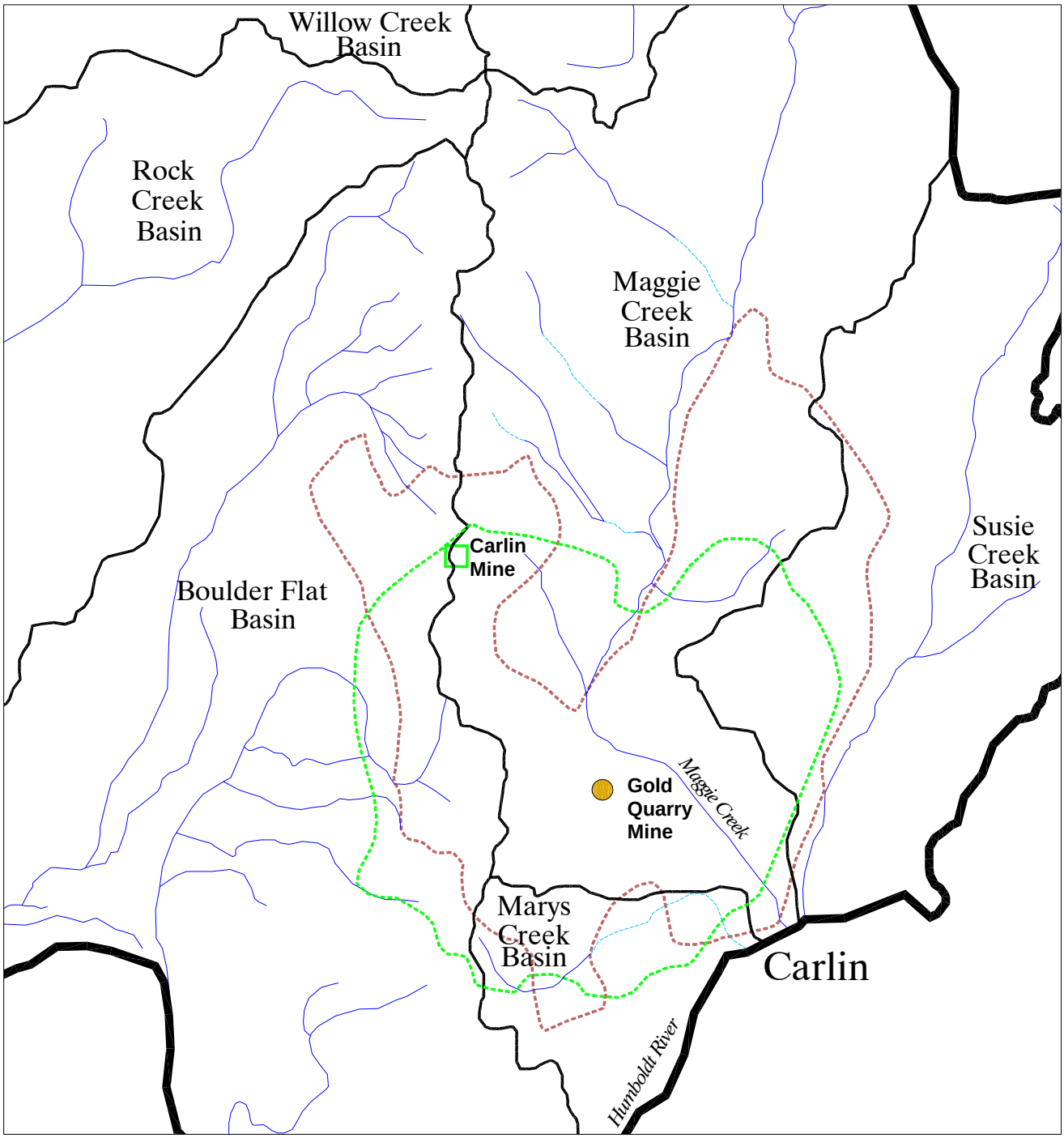
No drawdown is apparent in the Carlin Formation. However, water levels have been rising to the south of Maggie Creek Ranch Reservoir, likely due to seepage from the reservoir, reduced pumping from the Carlin Formation near Gold Quarry, increased recharge along Maggie Creek as a result of mine dewatering discharge, and not pumping the Hadley Field irrigation wells (**Figure 4-4**).

Some localized increases in groundwater levels may continue to occur in the Carlin Formation underlying the Maggie Creek Ranch Reservoir and lower Maggie Creek. Groundwater level increases below the reservoir result from seepage out of the reservoir. When lower Maggie Creek has additional flow during the dewatering period, groundwater levels in this area increase also. Current monitoring in Maggie Creek Basin shows that water levels increased by up to 45 feet from 1992 to December 1998 directly south of Maggie Creek Reservoir in the Carlin Formation (Newmont, 1999c).

Monitoring well data indicate that water levels in the Carlin Formation directly south of the reservoir may not rise further, however water levels farther from the reservoir may continue to rise while water is being stored in Maggie Creek Reservoir. Water infiltration from the additional discharge in Maggie Creek would contribute to this rise. The increase of water levels in the Carlin Formation is also due to reduced pumping for irrigation, as irrigation demand is now met by Gold Quarry dewatering pumping from lower formations. The rate of increase would most likely slow down, and possibly a steady state would be reached during the life of the mine. There is not likely any significant flow from the Carlin Formation to the bedrock aquifer as a result of the groundwater mound caused by the Maggie Creek Ranch Reservoir. The base of the Carlin Formation has a clay layer of substantial thickness and most monitor wells throughout the area show no definite connection. Water levels in the Carlin Formation in the upper Maggie Creek Basin are expected to fall in the future because of dewatering in the underlying aquifers.

Impacts on Wells

Drawdown of groundwater due to dewatering activities would have limited impacts on some wells in the vicinity of the South Operations Area beyond the impacts already stated in the original EIS (BLM, 1993). Impacts could include decreased water yield, increased



Souce: HCI, 1999; BLM, 1993; Newmont, 1999c.

LEGEND

= Original Gold Quarry Mine (shallow layers) Using 1993 EIS Model (BLM, 1993a)

= Gold Quarry SOAPA (shallow layers) Using Carlin Trend Model (HCI, 1999)

= Basin Boundary

= Model Boundary

= Perennial Streams

= Intermittent Streams

0 10 20 30 40

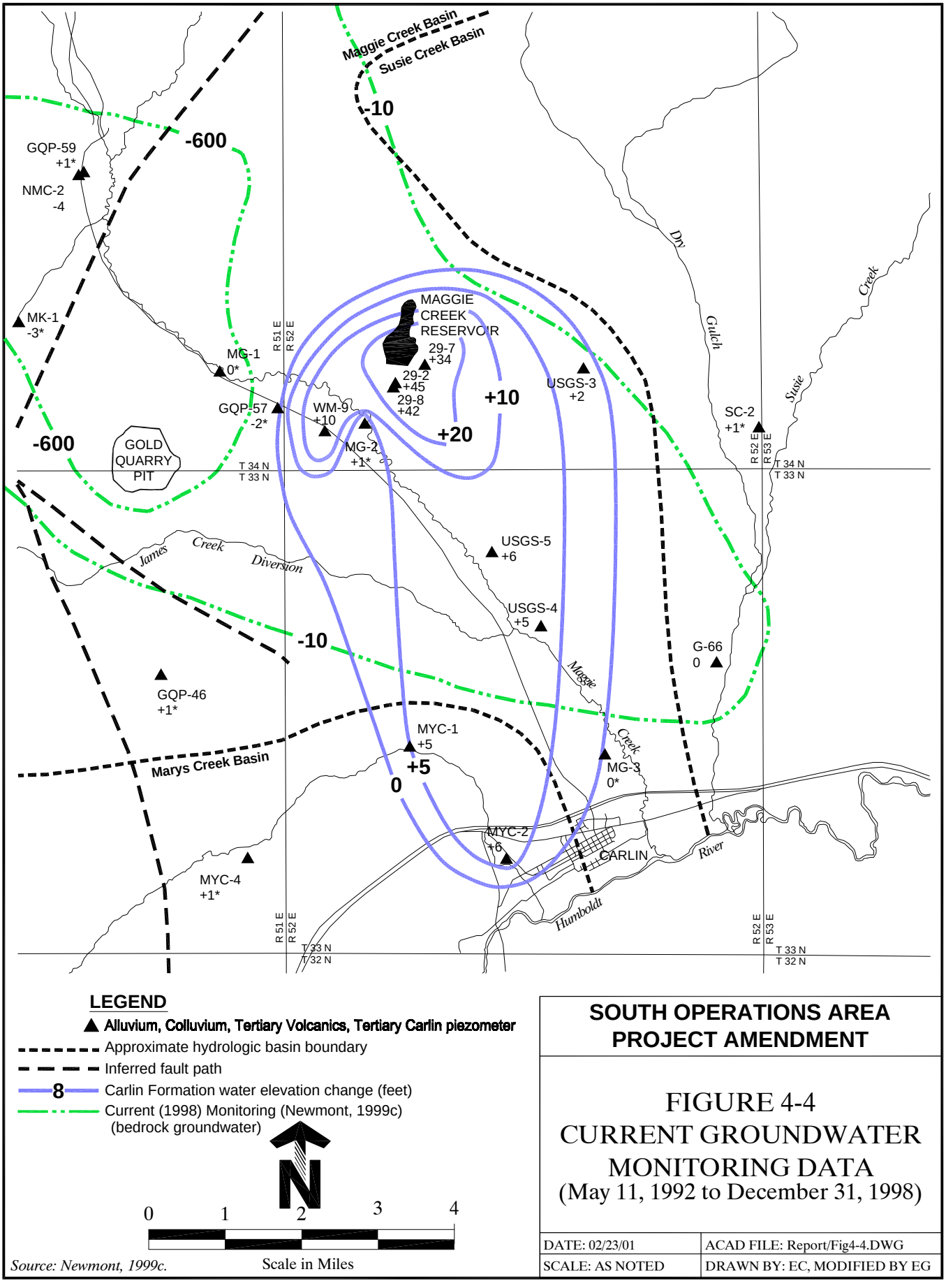
Scale in Miles

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-3

MAXIMUM EXTENT OF 10ft DRAWDOWN CONTOUR IN WATER TABLE AQUIFER PREDICTED BY 1993 EIS MODEL, AND THE 1999 SOAPA MODEL

MINE AREA: SOUTH AREA	
DATE: 02/26/01	ACAD FILE: Fig4-3.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-4
CURRENT GROUNDWATER MONITORING DATA
(May 11, 1992 to December 31, 1998)

DATE: 02/23/01	ACAD FILE: Report/Fig4-4.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

pumping costs, or possibly lowering the water level below the pump depth or the screen interval. The extent of impact would depend on the magnitude of drawdown with respect to well depth and type of aquifer(s) affected.

Locations of known wells, excluding Newmont's mining, milling, production, and monitoring wells, are shown in **Figure 4-5**, along with maximum extent of the 10-foot drawdown contour for the water table system. Wells outside this contour line are expected to be unaffected due to limited groundwater drawdown. Some time after dewatering ends, groundwater levels within the cone of depression would begin to rise.

There are **about 12** wells located within the maximum 10-foot drawdown contour **for SOAPA, but outside the 1993 analysis area in which 15 wells were analyzed in the drawdown contour** (**Figure 4-5**)**.** Included are private wells and non-mining wells owned by Newmont or the Newmont-owned company "Elko Land and Livestock." **Eleven of the 12** wells are currently predicted to be indirectly impacted by the Proposed Action.

Depths of well screen and static-groundwater levels are reported in **Table 4-1** for wells with available information. The difference between well screen depth and static water level generally is the available drawdown for withdrawal of water from a well. **Table 4-1** shows that available drawdown for the wells within the 10-foot drawdown area ranges from 7 to 484 feet.

Two wells have predicted drawdowns of more than 40 feet. Well screen depths for one of these wells is not available; thus the exact impact cannot be predicted. However, the drawdown is substantial, so an impact is likely. The eleven wells predicted to be impacted are highlighted on **Figure 4-5**. Maximum water level drawdowns would occur roughly between years 2000 to 2050. Wells located near Maggie Creek may not experience water level declines during the dewatering period because of groundwater recharge from dewatering flows added to the creek.

Several private and public wells are located in or near the town of Carlin (**Figure 4-5**). One of these wells (#62 on **Table 4-1**) is part of the town's public water supply. This well is 649 feet deep with a water level approximately 165 feet below ground surface. Another well (#37 in **Table 4-1**) is used by the town of Carlin for irrigating a park and is approximately 100 feet deep (Balleau Groundwater Consulting, 1992). Maximum groundwater drawdown in these two wells and other wells in the Carlin area resulting from the South Operations Area cone of depression would be less than 20 feet (a drawdown of up to ten feet was predicted in 1993); therefore, use of these wells should not be significantly impacted. The Carlin "Cold" Spring system used as a public water supply source in Carlin is discussed below.

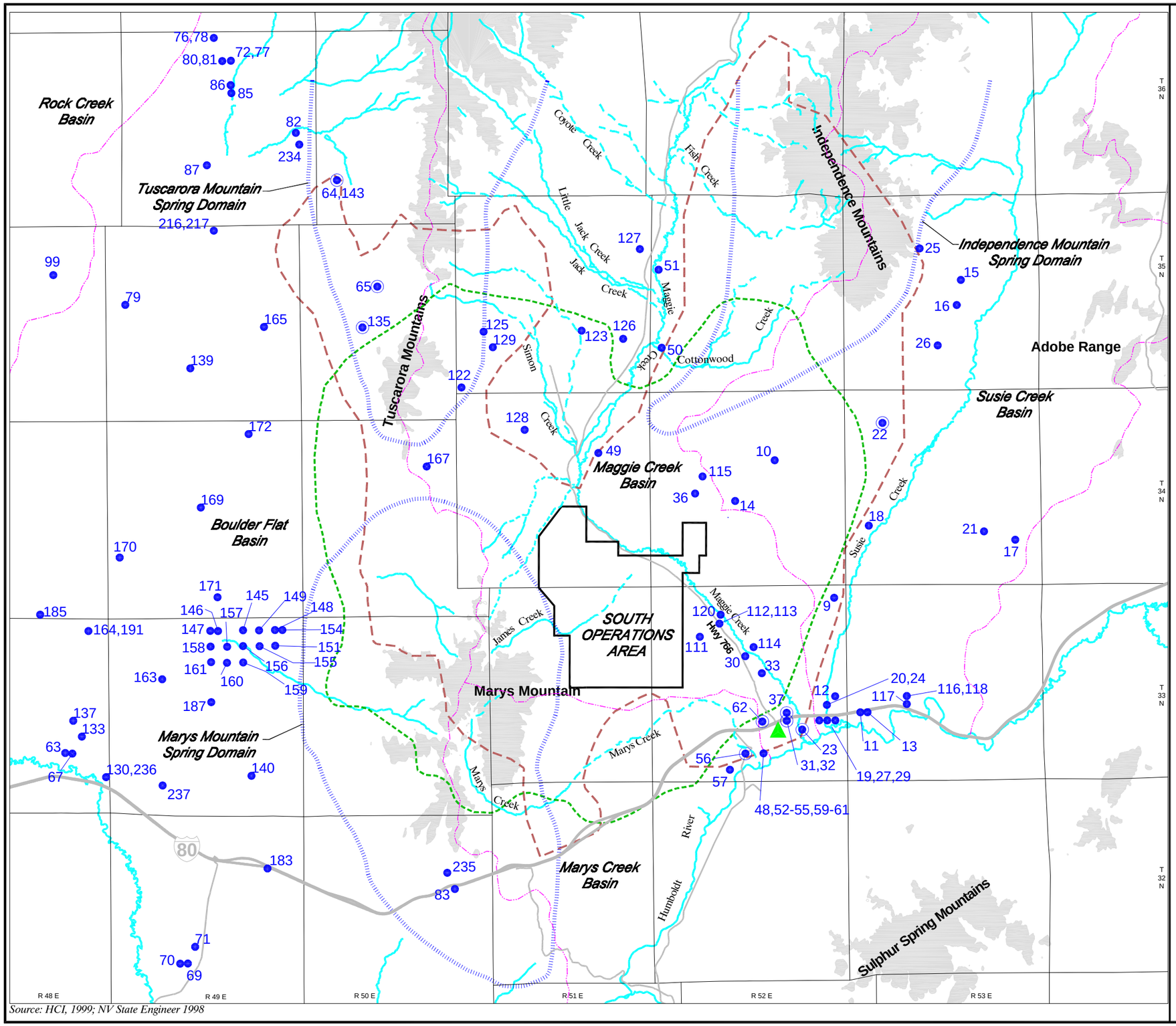
Impacts on Springs and Seeps

There are numerous springs and seeps in the South Operations study area that are important to the area's ecosystem (Chapter 3, Water Resources). Springs are categorized into two main types: (1) springs located primarily in mountainous areas fed by perched aquifers separated from the water table system due to elevation and geologic conditions; and (2) water table springs associated with regional groundwater systems and generally located at lower elevations. This division is generalized and there may be some mixture of spring types in the mountain and valley areas.

TABLE 4-1
GROUNDWATER WELLS POTENTIALLY IMPACTED BY SOAPA DEWATERING

Map #	Permit Number	Status[1]	SWL[2] (feet)	Bottom Screen[3] (feet)	Max. Avail. Draw-down	SOAPA EIS Estimated Drawdown (feet)	Location[4] TN	RE	Sec.	QQ	QTR	Use[5]	Diversion Rate (cfs)	Annual Duty (Acre-Feet)	Owner	Comment
Water Wells Inside 10-foot Drawdown Contour																
22	53179	CER	375	600	225	25	34N	53E	5	SW	SW	STK	0.031	22.41	Maggie Creek Ranch, Inc.	
23	54522	CER	10	170	160	<10	33N	52E	26	SW	NE	COM	0.056	0.03	The Anschutz Marketing and Trans.	
31	20227	CER	23	76	53	13	33N	52E	26	NW	NW	IRR	0.045	5.59	Meierhoff, Randy & Carmelia	
32	22214	CER	17	24	7	13	33N	52E	26	NW	NW	IRR	0.011	7.20	Meierhoff, Ralph J.	Entirely Dewatered
37	51981	PER				13	33N	52E	23	SW	SW	MUN	2.000	735.57	Carlin - City of	
56	35107	CER				<10	33N	52E	33	NE	NE	IRR	0.897	101.97	Jones, Melvin R.; Jones, Rachel S.	
62	52266	PER	165	649	484	<10	33N	52E	27	NE	NW	MUN	0.560	405.58	Carlin - City of	
64	28197	CER				10	36N	50E	30	NW	SE	MM	0.140	96.83	Polar Resources Company	
65	30615	CER	NR	243		48	35N	50E	10	SW	SE	MM	0.160	64.29	Polar Resources Company	Impacted
135	23881	CER				48	35N	50E	22	NW	NW	STK	0.045	5.10	Newmont Gold Company	Impacted
143	28969	CER	10228			10	34N	50E	19	NW	NW	STK	0.012	17.93	Elko Land and Livestock, Co.	
Application for Water Rights Inside 10-foot Drawdown Contour																
	36901	RFP					33N	52E	12	NE	SW	IRR	5.400	N.S.	Jefferson, Thomas F.	Application Only
	36994	RFP					33N	52E	12	NW	NE	IRR	5.400	N.S.	Johnson, Ernest W.	Application Only
	36996	RFA					34N	52E	36	NE	SE	IRR	5.400	N.S.	Boyer, David E.	Application Only
	36999	RFA					33N	52E	1	SW	NE	IRR	5.400	N.S.	Salley, Curtis R.	Application Only

N/A = not applicable
N.S. = Not Specified
1 CER= Certificate; PER= Permit; RFA= Ready for Action; RFP= Ready for Action (Protested).
2 SWL = approximated static water level as feet below ground surface based on well log information; NR = not reported.
3 Depth of bottom of screened interval in feet below ground surface.
4 Sec = section; TN = township north; RE = range east; QTR = quarter section; QQ = quarter quarter section.
5 IRR = irrigation; STK = stock; MUN = municipal; MM = mining and milling; COM = commercial.



Source: HCI, 1999; NV State Engineer 1998

LEGEND

- 15 Wells of Record, 1998
- 15 Wells Likely to be Impacted
- Carlin
- 1999 Predicted 10ft Drawdown Contour
- 1993 Predicted 10ft Drawdown Contour
- Hydrologic Basins
- Perennial Streams
- Intermittent Streams
- Spring Domain
- Mountain Ranges

N

0 1 2 3 4 5 6

Scale in Miles

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-5 PREDICTED IMPACTED WATER WELLS

MINE AREA: SOUTH AREA	
DATE: 8/1/00	ACAD FILE: Fig4-5.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY: DS

The perched springs in mountainous areas are divided into three spring "domains" (Marys Mountain, Tuscarora Mountains, and Independence Mountains), which represent the general area of mountain springs in the study area (**Figure 4-6**). Surface traces of the Tuscarora fault zone and other basin-bounding structures help define the mountain spring domains in the Maggie Creek Basin. Generally, perched springs located within the mountain domain areas would not be affected by mine dewatering. An exception might be springs with a deep bedrock source. Several springs in the Marys Mountain and Independence Mountain domains appear to be associated with a deep bedrock groundwater and the source could potentially be impacted by mine dewatering. Springs not located within the domains generally are associated with the regional water table system that would be intercepted and dewatered by the Gold Quarry Mine.

The highlands area located to the west and southwest of the Gold Quarry Mine includes the southern portion of the Tuscarora Mountains and the Marys Mountain area (**Figure 4-6**). For this discussion, this area is informally referred to as the Marys Mountain block. As illustrated in **Figure 4-6**, numerous springs are located within the Marys Mountain block; however, water-level data from bedrock wells in this area are sparse. As shown in **Figure 4-5**, three monitoring wells are located within or near the flanks of the mountain block. These three wells indicate that groundwater levels are at an elevation of approximately 6,000 feet and are near-surface or artesian (with measured water pressures equivalent to water-level elevations above the ground surface). A series of springs that issue from the bedrock along the eastern flank of the Marys Mountains occur at an elevation of approximately 6,000 feet, similar to the water-level elevations measured in the nearby wells. The water quality of the springs and wells is a similar calcium bicarbonate type with relatively low concentrations of total dissolved solids and neutral to slightly alkaline pH. Limited oxygen isotope data from several of these springs indicate a relatively fresh water and similar recharge source (Newmont, 1999c).

Groundwater flow is assumed to be complex across this area. (It is conceivable that the spring domain within the Marys Mountain block could be controlled by localized perched groundwater systems.) Since mine dewatering is predicted to eventually lower the heads in the deep bedrock system underlying the Marys Mountain block area, several springs in this area potentially could be impacted by drawdown. This includes the series of springs located along the eastern flank of the Marys Mountains, discussed in the previous paragraph, and springs located below an elevation of 6,000 feet. The potential for impacts to other springs above 6,000 feet elevation is considered low. To date, no impacts to springs in the Marys Mountain block area have been recorded.

Several studies support the separation into perched mountain springs and regional water table springs. Two recent studies investigated source and age of water for springs in the Carlin Trend area (Maurer et al., 1996; and Plume, 1994). Tritium levels were measured on eight springs. High tritium levels indicate that water was recently recharged from the atmosphere. Springs with high tritium levels are commonly associated with the higher perched mountain domain springs. Four springs at or below 5,000 feet elevation had tritium levels below detection limits, and are therefore associated with a deeper aquifer where water has been in storage much longer (including Newmont monitored springs No. 40 and 52). The remaining springs ranging in

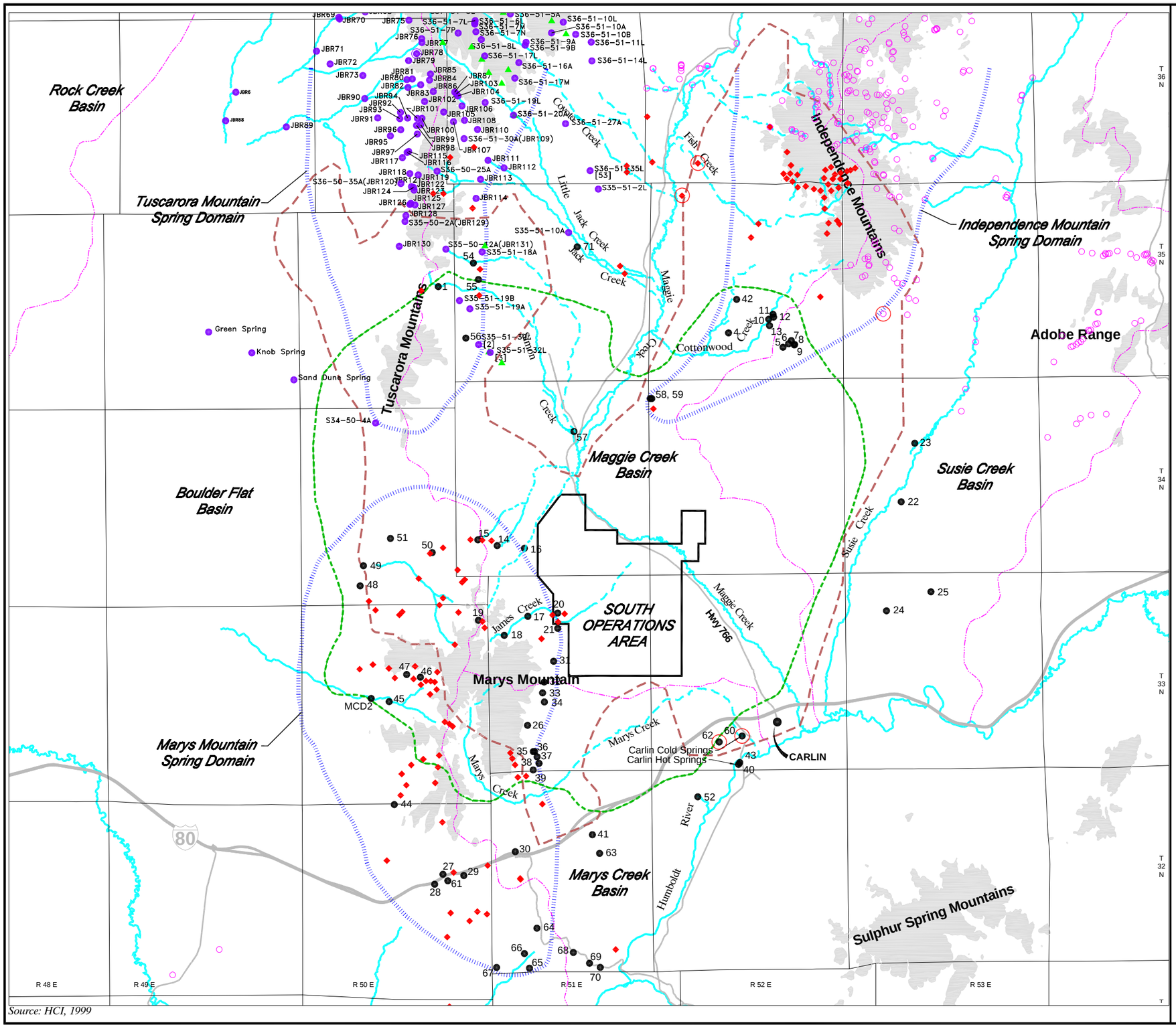
elevation from 4,930 feet elevation to 6,030 feet elevation had tritium levels indicating that the recharge water was younger than 60 years (including Newmont monitored springs No. 2, 34, and 60). This indicates that springs between 5,000 and 6,000 feet are possibly associated with perched mountain aquifers. An elevation of 6,000 feet is believed to be a general division between the higher perched springs and the lower water table springs (Balleau Groundwater Consulting, 1992). Water chemistry data including stable isotopes (deuterium and oxygen O^{18}), tritium, strontium, specific conductance, and chloride also indicate physical separation of the perched and water table flow systems (Balleau Groundwater Consulting, 1992; Zimmerman, 1992b). These data reflect the source and age of water from the springs and seeps.

In addition, the eastern boundaries of the Tuscarora and Marys Mountain spring domains coincide closely with an elevation of 6,000 feet. The Tuscarora Fault and associated faults along the east side of the Tuscarora Mountains in the South Operations area behave as hydrologic barriers to pumping activities at the Gold Quarry Mine. Drawdowns of several hundred feet have been observed in wells east of the fault system, whereas most wells west of the faults have shown no response to pumping at the Gold Quarry Mine (HCI, 1999, Appendix C).

Biannual surveys of selected springs have been conducted by Newmont since 1993 to establish baseline conditions (Newmont, 1999b). These surveys include flow measurements, water quality sampling and analysis, and vegetation description. The spring water chemistry data collected by Newmont do not confirm nor contradict the differentiation of springs into separate groundwater systems. The water chemistry of all springs is fairly similar, and no tritium data were collected. No significant effects on monitored spring flows were found due to Gold Quarry pit dewatering from the beginning of monitoring through Spring 1999. Anecdotal evidence exists of a thermal spring, or a group of thermal springs at the mouth of Maggie Creek Canyon. These springs, however, dried up before 1990, before spring monitoring began (Pettit, 1998).

Figure 4-6 shows maximum extent of the 10-foot drawdown contour line associated with the cone of depression resulting from dewatering at the Gold Quarry Mine (HCI, 1999). Springs and seeps located within this contour line that are not part of the perched spring domains are most likely to be impacted by Gold Quarry Mine dewatering. Some of these springs, however, are located adjacent to the spring domain boundaries and may be associated with the perched spring system. Magnitude of impact on any affected spring can vary from minor reduction in flow to complete elimination of flow. Location of each spring or seep in relation to the cone of depression and the spring's water pressure or head would determine, in part, the magnitude of impact.

Newmont would mitigate documented lost flows at springs or seeps by one of two means replacement of flow or provision of substitute water sources at nearby locations. Where impacted springs or seeps support sizable riparian areas or provide flow to adjacent creeks, replacement of flow would be implemented through the use of new water wells drilled at or near the affected spring. Flow replacement would be done such that the primary function of unimpacted spring and seep flow is maintained. Where impacted springs and seeps do not serve those functions,



Source: HCI, 1999

LEGEND

- S36–51–17L — Spring (JBR 1990, RTi 1994)
- Seep (RTi 1994)
- 67 — Spring (Newmont - monitored)
- Spring (Newmont - JBR 1992b)
- Spring (USGS 7.5' Quadrangles)
- 1999 Predicted 10ft Drawdown Contour
- 1993 Predicted 10ft Drawdown Contour
- Hydrologic Basins
- Perennial Streams
- Intermittent Streams
- Spring Domains
- Mountain Ranges

Note: Springs (with symbol ◯) inside the 10ft drawdown contour but outside spring domains are predicted to be impacted.

N

0 1 2 3 4 5 6

Scale in Miles

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-6 PREDICTED IMPACTED SPRINGS AND SEEPS

MINE AREA: SOUTH AREA	
DATE: 7/18/00	ACAD FILE: Fig4-6.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY: EG

but are important sources of water for terrestrial wildlife, substitute water sources would be provided through the use of guzzlers. In areas where springs and seeps are in proximity to one another, a single well or guzzler may be utilized to mitigate several impacted water sources.

Following the above definitions of locational relationships between the spring domains and the predicted 10-foot drawdown contour, the following prediction of spring impacts can be made.

A total of 5 spring and seep sites is presumed to be potentially impacted by the expansion of the cone of depression. **Table 4-2** presents the potentially affected springs/seeps that were not analyzed in the 1993 EIS (BLM, 1993) (25 sites were identified in that analysis).

The numerical hydrogeologic model indicates a baseflow reduction in lower Marys Creek. Flows at the Carlin "Cold" Spring (Carlin Water Supply source) would be reduced by about 1.7 cfs gradually during the dewatering period (HCI, 1999). The maximum decrease would be expected to occur around the year 2030. The Carlin Hot Spring (Spring #43) located adjacent to the Humboldt River just west of Carlin is not projected to be impacted. The Carlin Cold Spring (Spring #60) is located exactly on the 10-foot drawdown contour; the Carlin Hot Spring is located outside, but near the 10-foot drawdown contour. Since both springs are of concern, they would continue to be monitored.

Quality of spring and seep water is not expected to be affected by the SOAPA dewatering operations. No significant changes in the hydrogeologic system that controls water quality would occur as a result of the Proposed Action. Predicted mine pit water quality after cessation of mining is discussed in a later section. Following the year 2011, impacted spring and seep flows would begin to approach pre-mining conditions as groundwater levels begin to rise. Complete recovery of some springs and seeps may never occur, or take more than 100 years. While it is not possible to specify which springs or seeps would be affected, those closest to the project area would have the greatest probability of being impacted. Maximum impacts on springs and seeps would occur roughly between years 2000 and 2050 (HCI, 1999).

Impacts on Baseflow

Baseflow in some streams within the study area would decrease as a result of Gold Quarry Mine dewatering operations. Baseflow in lower Maggie Creek and the Humboldt River would increase during the dewatering period as a result of water discharged directly to Maggie Creek below Maggie Creek Canyon from the dewatering operations and the Maggie Creek Ranch Reservoir. Baseflow is defined as streamflow during the late fall and early winter period when agricultural diversions, runoff, and evapotranspiration are minimized and flow is primarily from groundwater contributions which are not influenced by seasonal runoff in Nevada. Baseflow measurements typically are made during the month of October. Baseflow would decrease in areas where the cone of depression intercepts groundwater that discharges naturally to the streams.

Reductions in baseflow can occur downstream of the 10-foot drawdown contour where groundwater flow that would discharge to streams is intercepted by the cone of depression. In the original EIS (BLM, 1993)

TABLE 4-2
SPRINGS AND SEEPS WITHIN THE INCREMENTAL 10-FOOT DRAWDOWN CONTOUR OF GOLD QUARRY MINE DEWATERING

Location[1] TN/RE - Section - 1/4,1/4	Newmont Inventory No.[2]	Developed[3]	Comments
36/52-32-NE			Fish Creek drainage
35/53-20-SW			USGS mapped spring
33/52-28-SW, SE	Spring 60	Developed	Carlin Cold Springs
33/52-28-SW, SW	Spring 62		
35/52-6-NE, SE			Adjacent to Maggie Creek

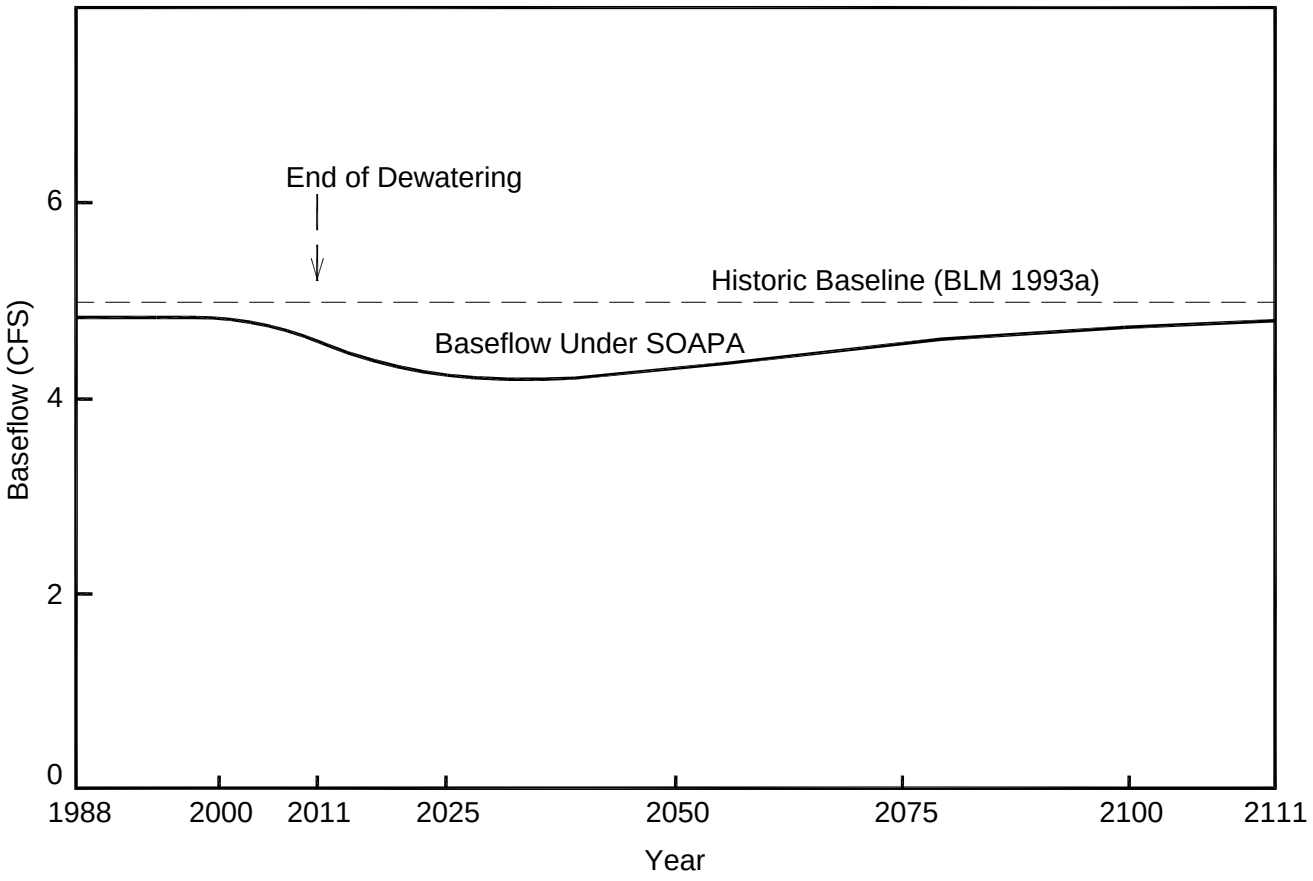
[1] TN = township north; RE = range east; 1/4 section of 1/4 section.
[2] Spring number assigned by Newmont as part of its periodic monitoring program; see Chapter 3, Water Resources.
[3] Developed means that spring/seep has undergone a man-made modification, primarily for stock watering purposes.

dewatering rates as high as 42,000 gpm (100 cfs) were assumed based on the earliest modeling efforts. Model refinements and the current dewatering program have shown that lower rates are sufficient. The currently predicted maximum dewatering rate is 25,000 gpm (56 cfs)(HCI, 1999). Average monthly flow **at the mouth of** Maggie Creek before mining was approximately 100 cfs during April and May, and less than 10 cfs from July through January, based on a 1913-1924 period of record (**Table 3-6**). Bankfull capacity of Maggie Creek below the canyon **(seven miles upstream)** is approximately 80 cfs (35,900 gpm) (Rosgen, 1992). Maximum flow recorded on Maggie Creek before mining was 2,440 cfs (1,095,000 gpm) on February 12, 1962 (Schroer and Moosburner, 1978).

Currently, water is discharged to lower Maggie Creek, except during periods of natural high flows in Maggie Creek. In 1998, more than 18,500 acre feet were discharged into Maggie Creek (25.5 cfs/11,400 gpm). Discharge would continue through the dewatering period until 2011 at rates of less than 65 cfs (29,200 gpm). The maximum rate of 65 cfs is based on a predicted maximum dewatering rate of 55 cfs (25,000 gpm) plus an average discharge rate from the reservoir of 10 cfs (4,500 gpm). The BLM (1993) analyzed discharge rates of up to 104 cfs (46,700 gpm). Some water infiltrates through the Maggie Creek channel and recharges the underlying alluvial groundwater system during the period of mine water discharge to Maggie Creek.

When dewatering and associated discharge cease, baseflow of Maggie Creek would decline as a result of the cone of depression that extends over a portion of the Maggie Creek Basin (**Figure 4-3)**. At the gaging station located on Maggie Creek just below the canyon, flow generally is less than 4 cfs (1,800 gpm) or absent during the period July through October.

Baseflow in upper Maggie Creek from Jack Creek to the upper end of Maggie Creek Canyon would be temporarily reduced by about 0.6 cfs (269 gpm) after cessation of dewatering (HCI, 1999) (**Figure 4-7**). The temporary reduction in 1993 was estimated at 2-4 cfs (BLM, 1993). Impacts would be associated primarily with a reduction in baseflow for the reach immediately above the

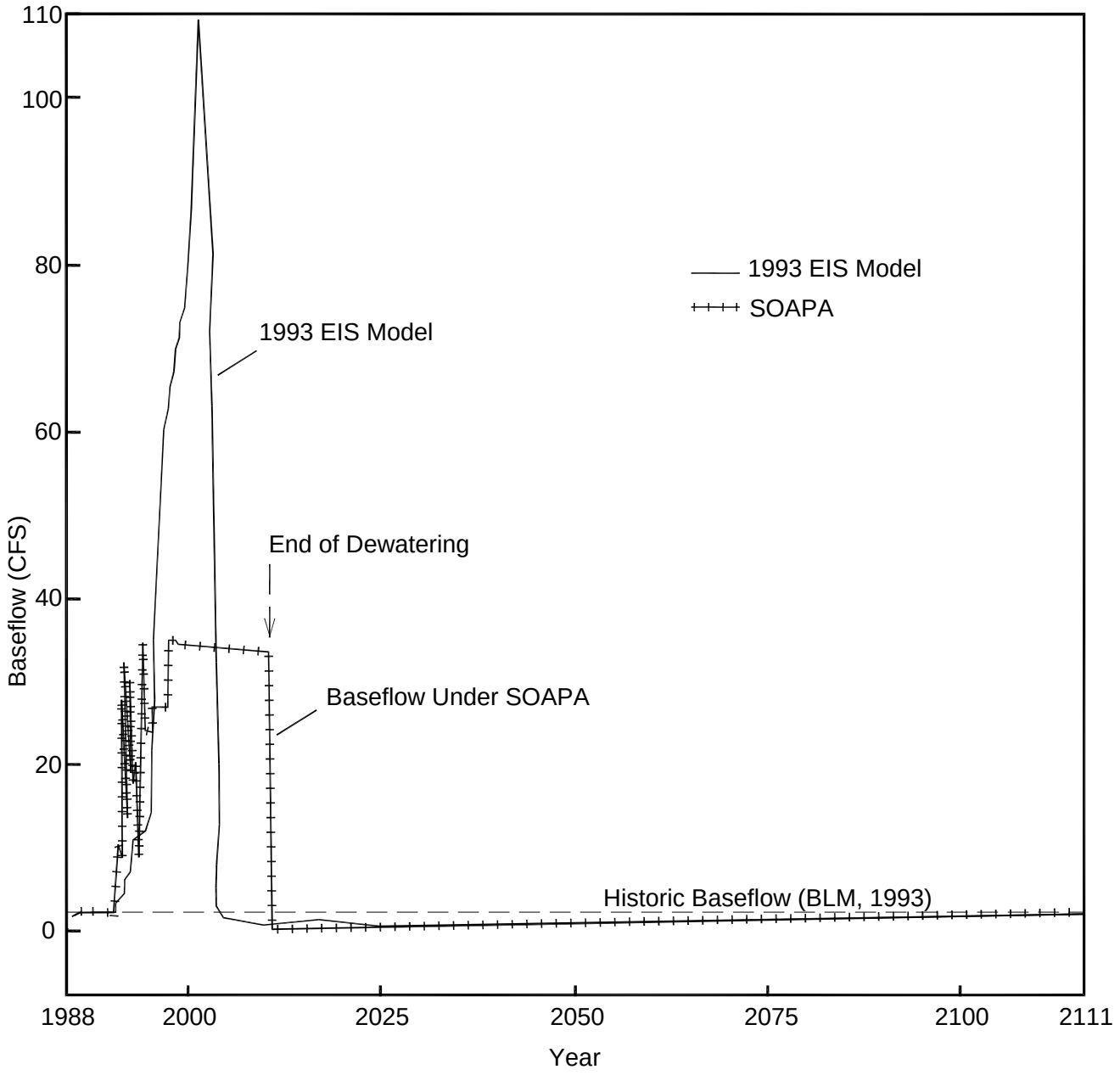


SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-7
PREDICTED BASEFLOW
IN UPPER
MAGGIE CREEK

DATE: 6/6/00	ACAD FILE: Fig4-7.DWG
SCALE: NTS	DRAWN BY: ML, MODIFIED BY EG

Source: HCI, 1999.



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-8
PREDICTED BASEFLOW
IN LOWER
MAGGIE CREEK

DATE: 02/23/01	ACAD FILE: Report/Fig4-8.DWG
SCALE: NTS	DRAWN BY: ML, MODIFIED BY EG

Source: HCI, 1999.

Maggie Creek Canyon. Maximum reductions in Maggie Creek baseflow are predicted to occur around 2040, followed by a gradual increase in baseflow (**Figure 4-7**).

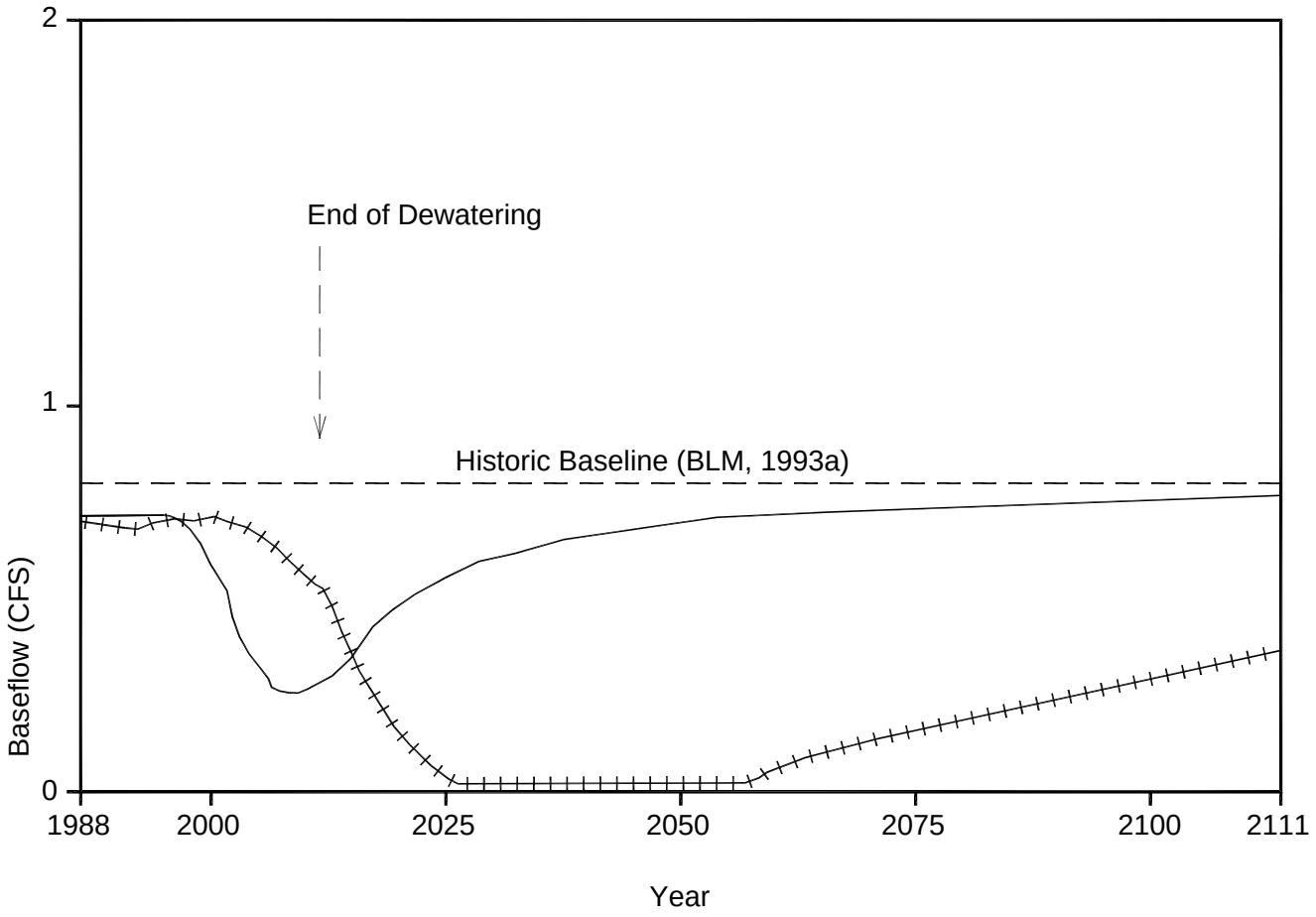
Lower Maggie Creek is naturally intermittent and loses flow below the canyon. Shortly after mine water disposal ceases, lower Maggie Creek would again be dry during baseflow conditions (**Figure 4-8**) (HCI, 1999). This would occur under the original plans (BLM, 1993) as well as for the extended mining period proposed by SOAPA. Maggie Creek is naturally dry during the summer months in dry years**, during normal and wet years, Upper and Middle Maggie Creek generally has baseflow on the order of 1 cfs. For the model a baseflow of 1.3 cfs had been assumed (Figure 4-8), however, studies by Plume (1994) and Maurer et al. (1996) indicate that the baseflow in lower Maggie Creek is zero.**

Several tributaries to Maggie Creek have portions of their length located within the incremental 10-foot drawdown contour (**Figure 4-1**). Upper reaches of these streams above approximately 6,000 feet generally are perennial, flowing continuously due to springs in the mountain areas. For many of the tributaries north of Maggie Creek Canyon, the springs feeding the streams are in theTuscarora or Independence Mountain Spring domains. The lower reaches of these streams are ephemeral or intermittent and generally flow only in response to snowmelt runoff and precipitation. These piedmont areas are major zones of recharge to the groundwater system (Berger, 1999). Some springs in the lower reaches of these streams provide continuous flow to short segments. Baseflow in portions of these streams may be reduced or **the naturally occurring dry periods could be extended by approximately one month each fall** during and after dewatering at the South Operations area.

Fish Creek supports a limited amount of riparian vegetation. The creek would not be substantially affected by dewatering since it is primarily within the Independence Mountain spring domain, but a spring in the lower reach could potentially be dewatered. If so, then riparian areas along the lower reaches might experience some effects from reduced flow. Lower Fish Creek is an intermittent stream.

A short reach of lower Susie Creek will continue to be dry during the fall/winter months. This reach is located above Interstate-80 and extends from the USGS gaging station approximately one mile upstream. Susie Creek is predicted to have maximum baseflow reductions due to SOAPA dewatering from approximately 2025 to 2065. Baseflow in the remainder of the creek is predicted to recover subsequently to within 0.05 cfs of pre-mining conditions (HCI, 1999) (**Figure 4-9**). The BLM (1993) analyzed a decrease in baseflow of 0.5 cfs. However, lower reaches and is periodically dry in this area. Average annual flow measured in Susie Creek approximately 16 miles above its mouth during the period 1956-58 was 6 cfs, with average monthly flows ranging from 0.11 to 29.3 cfs (USGS, 1963). Historic baseflow of Susie Creek at this location was modeled at about 0.8 cfs (HCI, 1992), and a baseflow of 0.7 cfs was used in the 1999 modeling (HCI, 1999).

In 1993, Newmont committed to augment baseflow in Susie Creek if groundwater levels in monitoring wells fall to less than one foot above the elevation of the bed of Susie Creek,



* Only baseflow in fall and winter, but with normal flows in other seasons, during years 2026 to 2056.

Source: HCI, 1999.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-9
PREDICTED BASEFLOW
IN LOWER SUSIE CREEK
NEAR CONFLUENCE
WITH HUMBOLDT RIVER

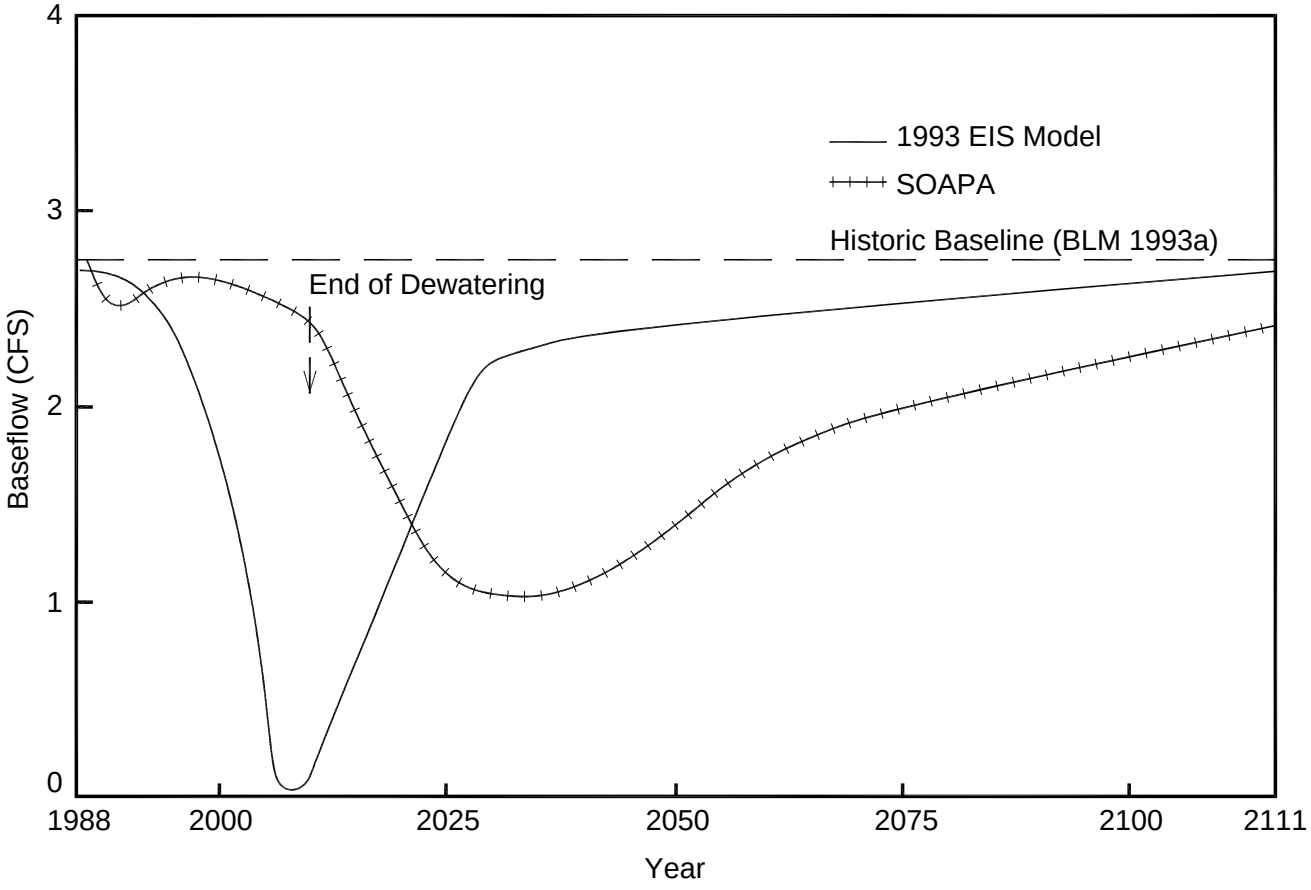
DATE: 02/23/01	ACAD FILE: Reports/Fig4-9.DWG
SCALE: NTS	DRAWN BY: ML, MODIFIED BY EG

or if flows have fallen below 0.8 cfs, and monitoring confirms these levels and BLM concurs. Two piezometers and two surface flow measurement sites would be used to determine the need for augmentation. Augmentation will consist of maintaining minimum flows as specified in the Susie Creek Augmentation Plan (BLM, 1993). Augmentation would be provided by the drilling of one or more wells in the area of the most upstream sampling site (SCS-1) and pumping water to low velocity transmitters in the creek bed via buried pipeline.

The predicted effect on baseflow in lower Marys Creek is shown in **Figure 4-10**. Flow at the mouth of Marys Creek generally consists almost entirely of discharge from the Carlin "Cold" Springs. The numerical model predicts that baseflow near the mouth of Marys Creek would decrease by as much as 1.7 cfs during dewatering (HCI, 1999), reducing flow at the Carlin "Cold" Spring complex. Impacts on flow in lower Marys Creek (i.e., the Carlin "Cold" Springs) would be greatest in about year 2030, followed by a gradual return to pre-mining conditions (**Figure 4-10**). Previous analysis (HCI, 1992) indicated as much as a 2.6 cfs reduction in baseflow in Marys Creek. Average annual flow of Marys Creek at its confluence with the Humboldt River during some very dry years before mining at Gold Quarry (prior to 1985) was around 3.0 cfs. Average annual flows for the period from 1989 to 1998 ranged from 2.8 to 12 cfs. No impact on ephemeral flow in upper Marys Creek is expected from dewatering because the sources of this surface water are primarily precipitation and perched springs in the vicinity of Marys Mountain.

Flow in the Humboldt River between the Carlin and Dunphy Gages is currently being augmented by mine water discharged to Maggie Creek (**Figure 4-11**). Average monthly flow in the Humboldt River at Palisade (between Carlin and Dunphy) has the following general characteristics: (1) exceeds 500 cfs during the period March through June; (2) ranges from 100 to 500 cfs in January, February, and July; and (3) is less than 100 cfs from August through December. Lowest average monthly flow occurs in September and October at rates of 32 and 47 cfs, respectively. Maximum and minimum flows recorded at Palisade are 17,000 and 9 cfs, respectively.

Newmont has evaluated flow in the Humboldt River before mining related discharge between the Carlin Tunnels gage and Rye Patch Reservoir to quantify the potential contribution from Gold Quarry Mine dewatering discharge (HCI, 1997). The Humboldt River between the Carlin Tunnels and Palisade gages has an annual average gain in flow of 51 cfs and an average baseflow gain (October) of 18 cfs (**Figure 4-12**). Between Palisade and Rye Patch Reservoir, the Humboldt River has natural gains and losses but has an average annual loss of 126 cfs and an average baseflow loss of 15 cfs (**Figure 4-12**). The addition of mine water to the Humboldt River, therefore, would temporarily help offset reductions in flow that occur naturally in the Humboldt River downstream of Palisade. The magnitude of changes in river baseflow that would occur and the length of stream that would be affected below Palisade are difficult to predict because of complex river dynamics, including inflow, outflow, bank storage, evapotranspiration, and irrigation withdrawals. **Figure 4-13** is a representative cross-section showing excess mine discharge water plotted with baseflow and bankfull flow in the Humboldt River

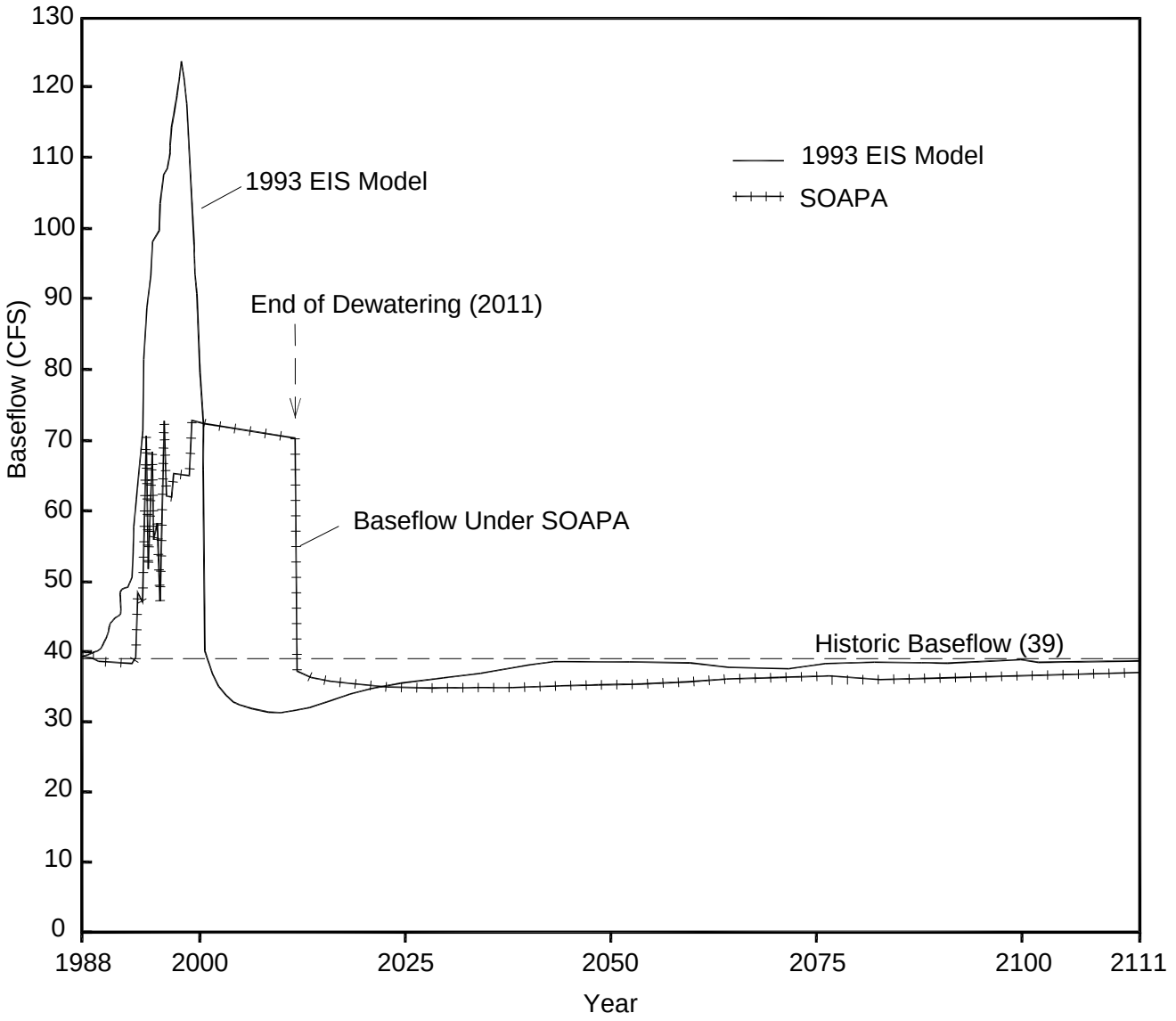


Source: HCI, 1999.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-10
PREDICTED BASEFLOW
IN MARYS CREEK
(CARLIN SPRING)

DATE: 02/23/01	ACAD FILE: Reports/Fig4-10.DWG
SCALE: NTS	DRAWN BY: ML, MODIFIED BY EG

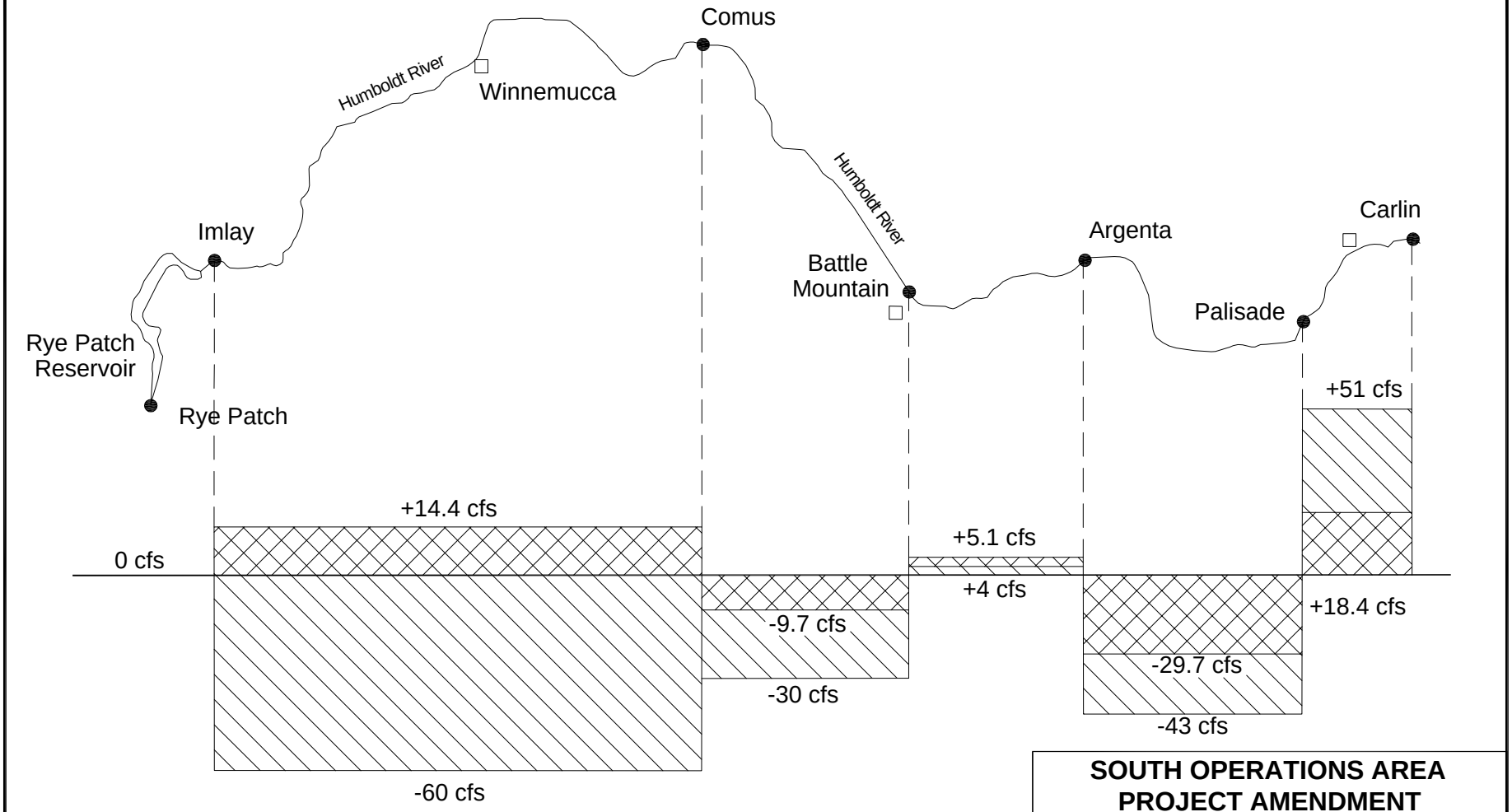


SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-11
PREDICTED BASEFLOW
IN HUMBOLDT RIVER
AT DUNPHY

DATE: 02/23/01	ACAD FILE: Fig4-11.DWG
SCALE: NTS	DRAWN BY: ML, MODIFIED BY EG

Source: HCI, 1999.

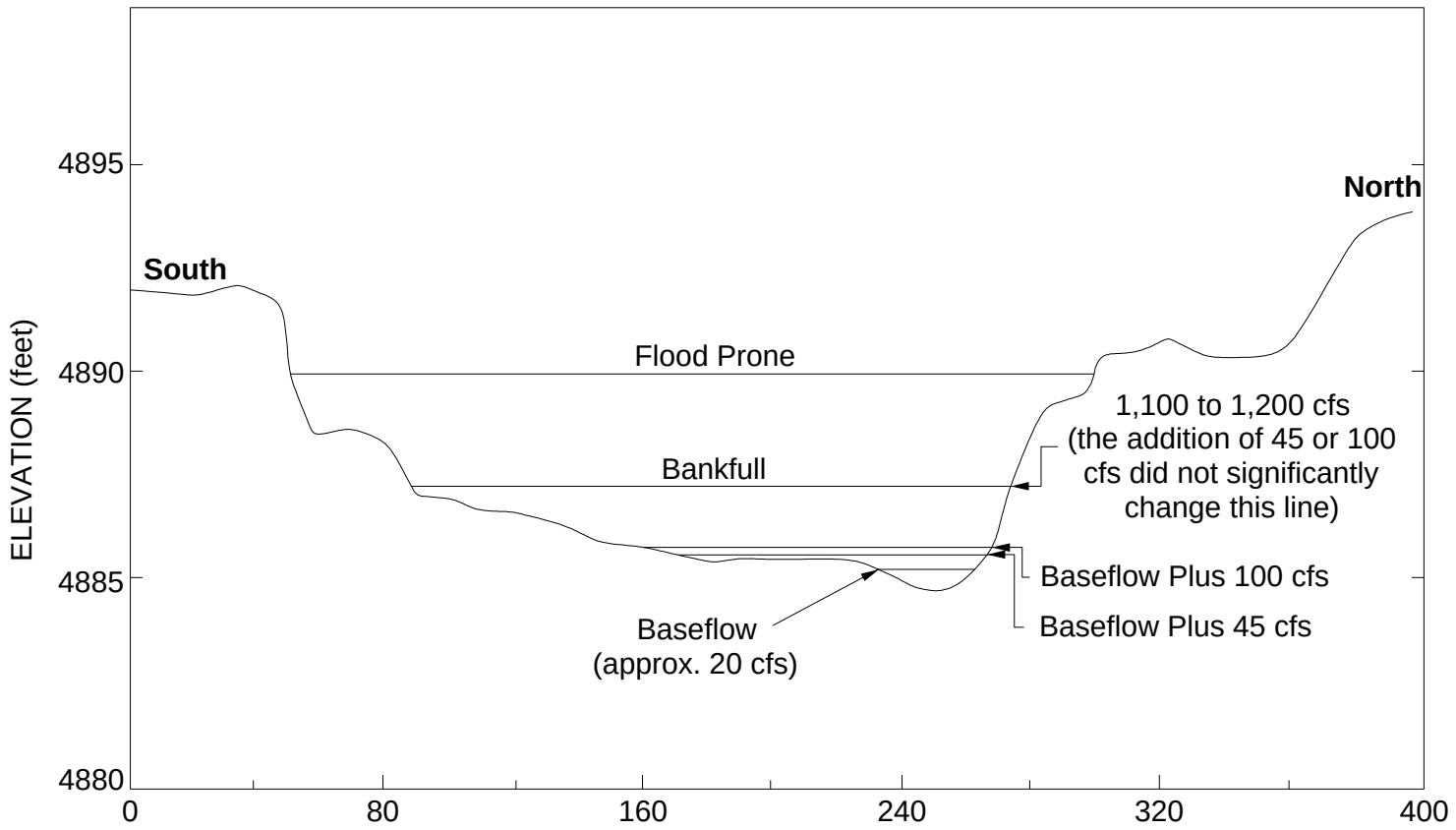


Source: RTI, 1998

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-12
HUMBOLDT RIVER FLOW NATURAL GAINS AND LOSSES BETWEEN GAGING STATIONS

DATE: 6/6/00	ACAD FILE: Fig4-12.DWG
SCALE: NTS	DRAWN BY: EC, MODIFIED BY EG



*Cross-Section Approximately 100 Yards Downstream From Maggie Creek, Looking Downstream

Source: Rosgen, 1992 as seen in BLM, 1993.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-13
HUMBOLDT RIVER
CROSS-SECTION

DATE: 6/6/00	ACAD FILE: Fig4-13.DWG
SCALE: NTS	DRAWN BY: EC, MODIFIED BY DS

immediately downstream from the Maggie Creek confluence. This flow increase in the Humboldt River is well within the active channel for low and moderate flows, and is nearly undetectable during high flows. As mentioned previously, during very high flows, mine discharge is routed to the Maggie Creek Ranch Reservoir.

Humboldt River baseflows after cessation of dewatering are estimated to decrease by a maximum of 4.9 cfs between Carlin and Dunphy gages (HCI, 1999) (**Figure 4-11**). The largest reduction is predicted to occur about the year 2030. The long term decrease in baseflow between the Carlin and Dunphy gages is predicted to be about 1.5 cfs (HCI, 1999). The BLM (1993) previously analyzed a maximum decrease of 19 cfs for that reach.

Surface Water Rights

Drawdowns of groundwater would have potential impacts on surface water flows, and therefore on the availability of water to satisfy surface water rights. There are 12 permits and certificates for surface water rights and vested water rights inside the 10-foot drawdown boundary (**Table 4-3** and **Figure 4-14**).

If surface flows are reduced to the point where surface water rights cannot be satisfied, the agricultural (grazing) or industrial uses (mining) would have to be altered or suspended, or a supplemental water supply provided. The mines have numerous other water sources available to supplement any lost water rights. Ranchers may not have other water sources available to satisfy their reduced or lost water right. In such a case, Newmont has agreed to subjugate some of their senior water rights to provide supplemental water. Potential water losses to irrigation water rights holders in the middle and lower Humboldt sub-basins would be mitigated by Newmont informing the Water Master of Newmont's calculation of the amount of water potentially lost, and instructing the Water Master to administer a like amount of Newmont's senior decreed water rights within the basins as if they were the most junior water rights in the sub-basins for that irrigation season. Newmont owns or controls senior decreed water rights within these sub-basins in excess of the maximum potential baseflow impact. Newmont would use a calculation presented in the Mitigation Plan (BLM, 1993) to determine the estimated loss of baseflow prior to April 1 each year mitigation is required. Newmont and the Water Master would determine each year which particular Newmont water rights would be used for this purpose.

Stream and River Channel Stability

Channel characteristics of Maggie Creek and the Humboldt River are summarized in Chapter 3, Water Resources. The addition of excess mine water on a continuous basis to lower Maggie Creek and the Humboldt River could potentially result in increased erosion.

The Humboldt River is not expected to experience significantly increased erosion because of its large channel capacity and fair to moderate bank stability (JBR, 1992a). The Humboldt River has a channel capacity of at least 1,000 to 1,500 cfs in the vicinity of Carlin and Palisade (U.S. Army Corps of Engineers, 1950 and 1976).

While the majority of Maggie Creek is not entrenched, portions of the lower Maggie Creek channel are deeply entrenched and flows that exceed bankfull widths in those

TABLE 4-3
POSSIBLY IMPACTED SURFACE WATER RIGHTS

Map[1] #	App #	Status Permit/ Certificate[2]	Certificate Number	Township	Range	Section	Quarter	Use[3]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)	Owner
Surface Water Rights within 10-foot drawdown contour											
11	18552	CER	6423	33N	52E	9	SE SE	IRR	5.143	809.9	Newmont Gold Company/Robert Hadley
24	50434	PER		33N	52E	28	SE	MUN	0.144	35.2	Carlin-City
25	50437	PER		33N	52E	28	SW SE	MUN	1.000	N.S.	Carlin-City
26	50438	PER		33N	52E	28	SW SE	MUN	3.000	N.S.	Carlin-City
27	50439	PER		33N	52E	28	SW SE	MUN	0.770	N.S.	Carlin-City
34	V01582	VST		33N	52E	28	SW SE	OTH	0.000	N.S.	Central Pacific Railway Co.
85	45509	CER	11660	33N	51E	10	SE NW	STK	0.346	84.2	Newmont Gold Company
86	63506	PER		33N	52E	26	NW NE	IRR	0.350	15.8	Newmont Gold Company
88	31214	CER	10430	33N	52E	33	NE NE	DEC	0.132	32.1	Jones, Melvin R.; Jones, Rachel S.
89	31215	CER	10431	33N	52E	33	NE NE	DEC	0.278	67.8	Jones, Melvin R.; Jones, Rachel S.
90	31216	CER	10432	33N	52E	33	NE NE	DEC	1.24	32.1	Jones, Melvin R.; Jones, Rachel S.
118	3474	CER	3609	34N	51E	29	SW SE	IRR		29.84	Charles Drake

Note: Not listed are the following surface water rights Springs that are tributary to the Humboldt river are considered appropriated, even if no specific right is recorded for them. Springs not tributary to the Humboldt River and on public land may be Public Water Reserves, which are reserved rights for livestock and domestic use.

[1] Refer to **Figure 4-14**

[2] Status: CER - Certificate
PER - Permit
RFA - Ready for Action
VST - Vested Right

[3] Use:
DEC - as Decreed
IRR – Irrigation
MUN - Municipal
N.S. - Not Specified
OTH - Other
STK - Stock Watering

locations generally cannot be dispersed onto a floodplain (Rosgen, 1992). Bankfull discharge in Maggie Creek is approximately 80 cfs (159 ac-ft. per day) as determined in the field and from a flood frequency curve for a 1.5-year return period (Rosgen, 1992). The zone of channel and bank saturation has increased during dewatering, contributing to instability. Streambank stabilization completed in 1994 was part of the South Operations Area Project Mitigation Plan (BLM, 1993).

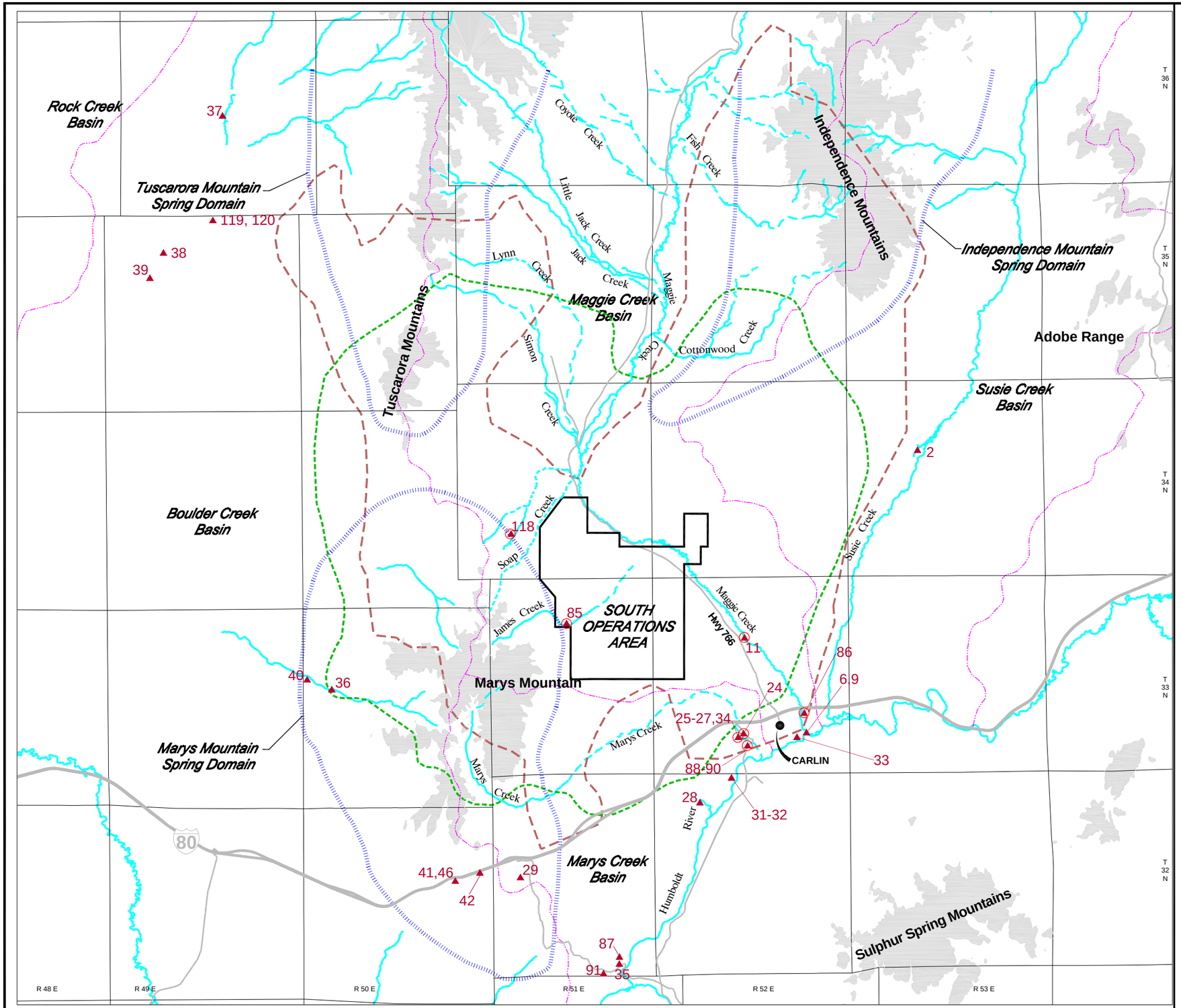
Based on flow and sediment rating curves, Maggie Creek before mining had an average sediment yield of 1,980 tons per year, including both suspended and bedload sediment (Rosgen, 1992). Sediment load is generally evenly divided between suspended and bedload material. Concentrations of total suspended solids in Maggie Creek and the Humboldt River in the study area during the period 1990-97 ranged from below detection to 1,100 mg/L (5,400 tons per year) and below detection to 7,100 mg/L (35,100 tons per year), respectively (**Table 3-8**). Relative changes in total suspended solids concentrations in the Humboldt River are higher during naturally low flow conditions when ambient sediment load in the river is low. No data on current sediment yield are available. The Proposed Action would not change total suspended solid concentrations or the sediment yield significantly above current levels, only the period of time during which water is discharged would increase. Lower Maggie Creek is characterized by the naturally high erodibility of its stream banks (Rosgen, 1992). To mitigate the potential effects of increased erosion and sediment transport, bank stabilization structures were designed and constructed at 29 locations in Maggie Creek in 1994 (Simons and Associates, 1994). The riprap revetment at the 29 locations has been designed for a flow rate of 130 cfs so that at flow rates lower than this, sediment transport from the bends is essentially reduced to zero. An inspection of lower Maggie Creek was conducted in the fall of 1997 (Hydro-Geo, 1997). The inspection revealed that the stabilization structures were performing as designed. High flows of up to 640 cfs (287,230 gpm) had not caused significant damage to the stabilization structures. Routine seasonal maintenance work was required at several locations. One location had a minor amount of bank caving and riprap movement. This location was also repaired as part of routine post-runoff season maintenance.

Mine dewatering flows of up to 17,400 gpm (38.9 cfs) in February 1997 had been managed using the current water management system. The SOAPA predicts flows of less than 23,800 gpm (65 cfs). This flow increase is within the capacity of the Maggie Creek Bank Stabilization structures and would not result in increased erosion and sediment production (Simons & Associates, 1997; Hydro-Geo, 1997). The original EIS (BLM, 1993) analyzed flows of 46,500 gpm (104 cfs).

At the point where dewatering discharge enters Maggie Creek, Newmont constructed a discharge structure to reduce the velocity of mine water. This prevents erosion at the discharge point due to increased flows.

Impacts on Water Temperature

Groundwater currently pumped from dewatering wells has an average temperature of about 30°C (86°F). Excess mine water is cooled and then discharged into Maggie Creek, from where it flows into the Humboldt River. As stated in Chapter 3, temperature of



Source: Nevada State Engineer, 1998; HCI, 1999.

LEGEND

- 15 Surface Water Rights
- 1999 Predicted 10ft Drawdown Contour
- 1993 Predicted 10ft Drawdown Contour
- Hydrologic Basins
- Perennial Streams
- Intermittent Streams
- Spring Domains
- Mountain Ranges

Note: Sites (with symbol ○) inside the 10ft drawdown contour are predicted to be impacted.

N

0 1 2 3 4 5 6

Scale in Miles

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-14 PREDICTED IMPACTED SURFACE WATER RIGHTS

MINE AREA: SOUTH AREA	
DATE: 8/1/00	ACAD FILE: Fig4-14.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

water in Maggie Creek and the Humboldt River varies considerably between seasons. Water temperatures in Maggie Creek and the Humboldt River are in the range of 0 to 30°C (32 to 86°F) (**Table 3-10**). The water cooling system is currently in use so that discharge water is cooled to a temperature necessary to maintain Maggie Creek above its confluence with the Humboldt River within 2°C (3.6°F) of ambient river temperatures as required by the discharge permit. The addition of mine water to lower Maggie Creek would reduce seasonal erosion caused by ice and freeze-thaw conditions (BLM, 1993).

Impacts on Surface Water Quality

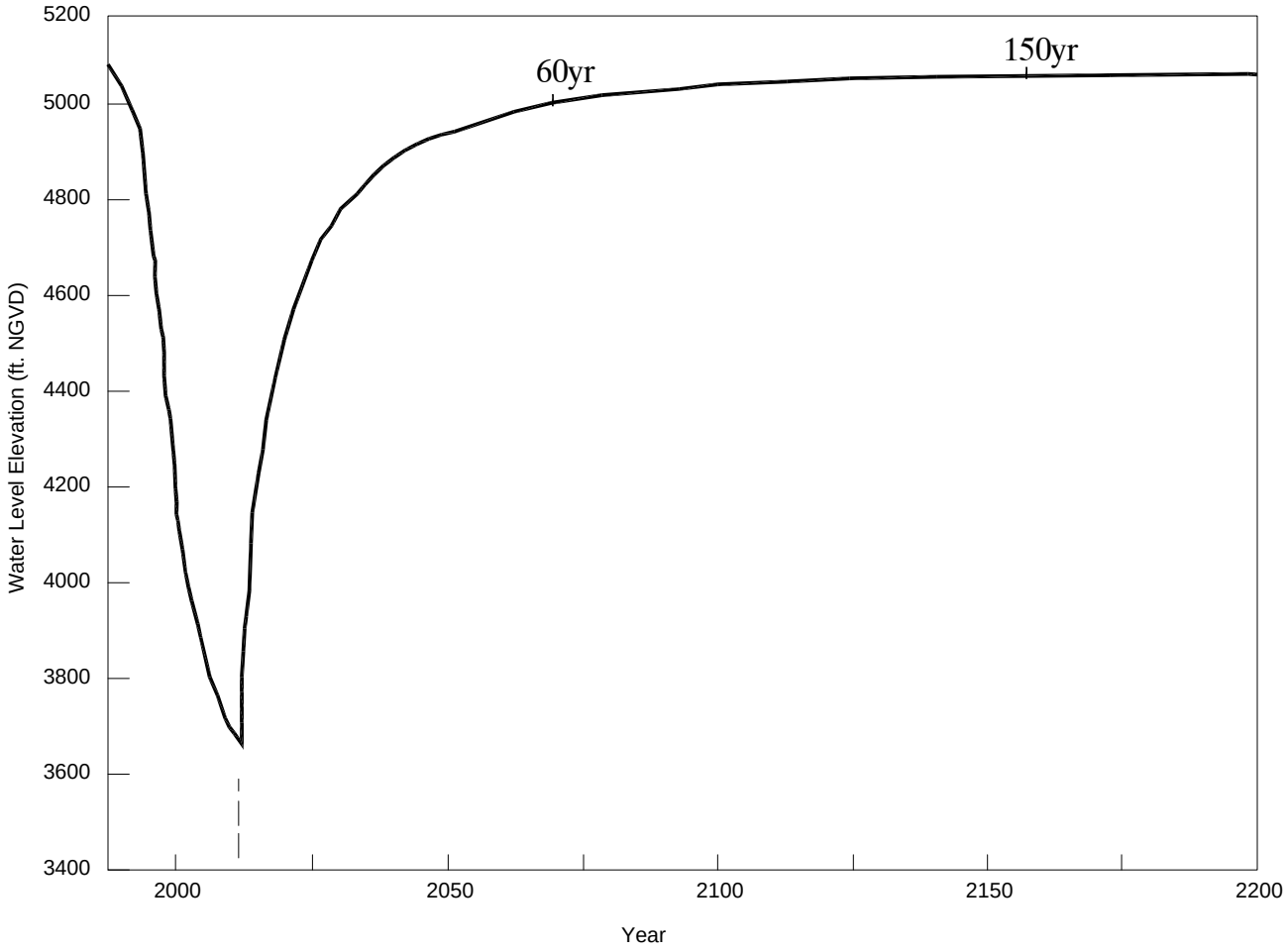
Groundwater at the South Operations area that is currently discharged to Maggie Creek has been pumped from the limestone aquifer (wells GQDW-10, GQDW-11, GQDW-12, GQDW-13, GQDW-14, GQDW-15, and MC-2). No treatment of this water is necessary, since the combined discharged water does not exceed the water quality standards established by the NPDES permit. Water pumped in the future would most likely exhibit similar characteristics. **Water quality in Maggie Creek currently may exceed water quality standards for cadmium, iron, and manganese. These exceedances are expected to continue because of the high background levels. This would also be true for aquatic life standards continuing to be exceeded by cadmium, iron, mercury, and selenium.** No water quality impacts are expected from discharge of excess mine water to Maggie Creek and the Humboldt River. If the quality of the pumped water should unexpectedly deteriorate, a previously installed, but little used, water treatment facility to treat groundwater can be returned to operation. Water from this facility would meet all water quality standards established by the NDEP.

Impacts from Mine Pit Water Recovery

At completion of dewatering, a mine pit lake would begin to form as groundwater flows into the pit (**Figure 4-15**). The groundwater model predicts recovery of the pit lake ultimately to less than 8 feet below pre-mining water levels (HCI, 1999) (**Figure 4-16**). The lake would be approximately 1,370 feet deep**,** cover an area of approximately 400 acres**, with a volume of 60 billion gallons (Geomega, 2001)**. Under the previous analysis (BLM, 1993) the pit lake was estimated to have an ultimate depth of approximately 775 feet and cover an area of approximately 190 acres.

The groundwater gradients in the aquifers intersecting the pit surface are locally to the southeast. Pit lake outflow will begin to occur at a recovery stage of 70 percent, and increase to approximately 2,300 acre-feet per year (1,440 gpm or 3.2 cfs) at 100 percent recovery (HCI, 2001). The outflow will report to the Paleozoic bedrock, not the Carlin Formation or the surface waters. The pit lake water quality is expected to be similar or better than background water quality, and is not expected to degrade the groundwater quality (Geomega, 2001).

The pit lake surface would be approximately 300 feet below the eastern mine pit rim. Net evaporation from the final Gold Quarry pit lake would be an estimated maximum of **994** acre-feet per year (6**16** gpm or 1.**4** cfs) (**HCI, 2001**).



Source: HCI, 1998.

SOUTH OPERATIONS AREA PROJECT ADMENDMENT

FIGURE 4-15
PREDICTED WATER LEVELS IN GOLD QUARRY PIT

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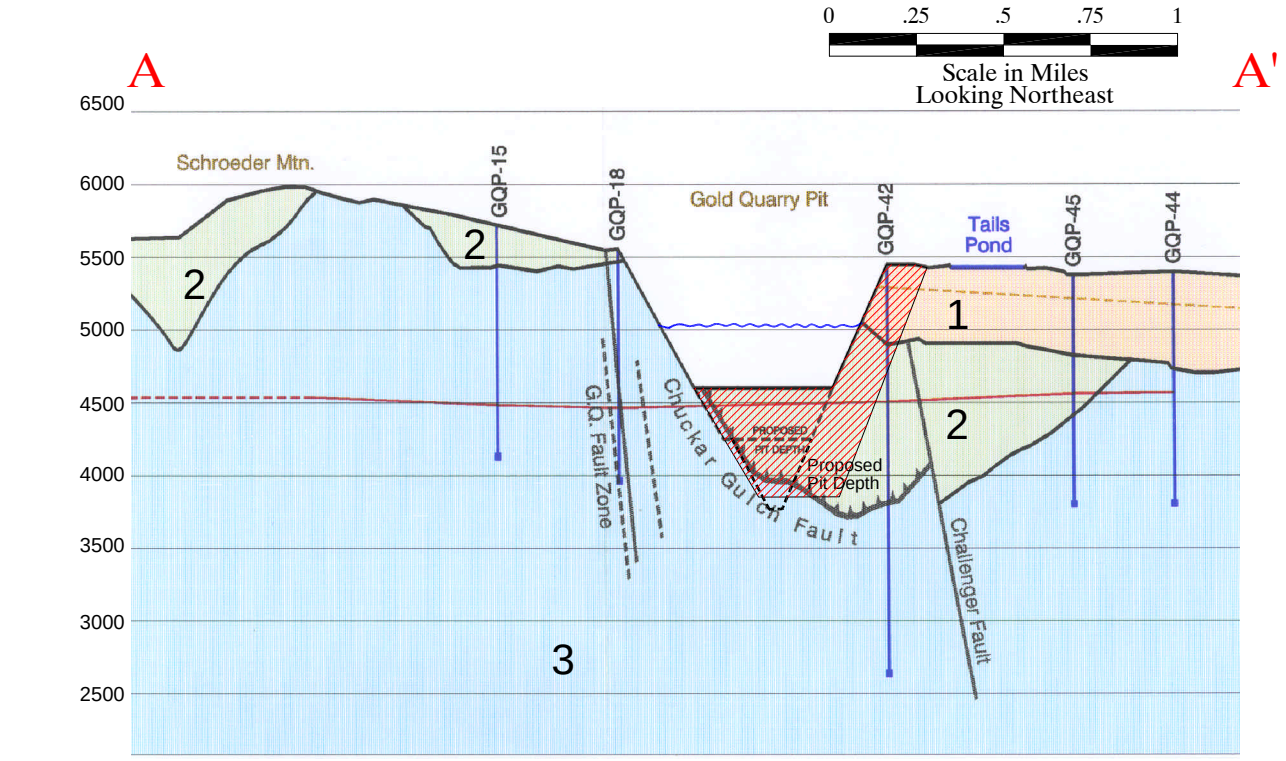
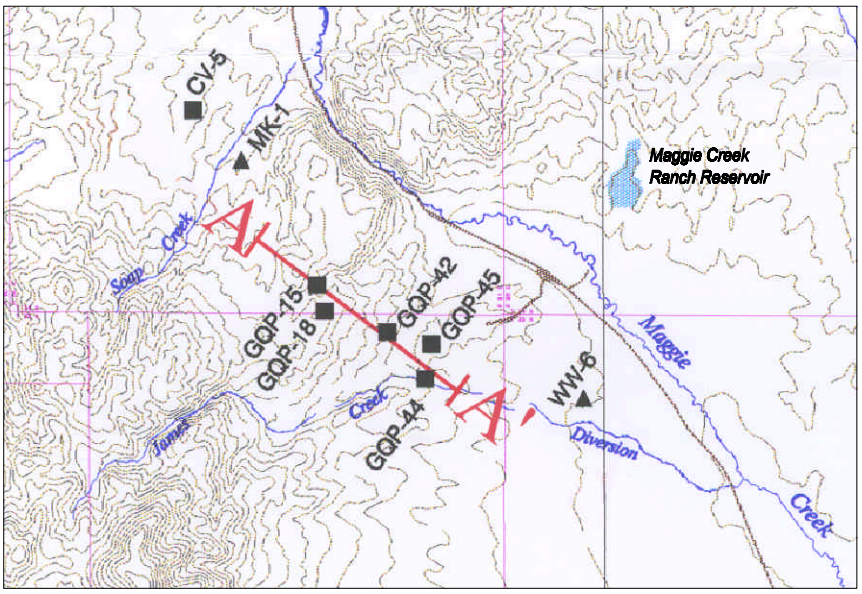
SCALE: NTS	DRAWN BY: ML, MODIFIED BY DS





Carlin formation water elevation
Mountain block siltstone/carbonate water elevation
Siltstone/carbonate water elevation
Estimated Surface of Pit Lake
1 Alluvium/Colluvium/Carlin (Tertiary)
2 Siltstone (upper plate)
3 Carbonate (lower plate)
SOAPA Proposed Pit Expansion
Alluvium/Colluvium/Volcanics (Tertiary)/Carlin (Tertiary) screen completion
Siltstone screen completion
Carbonate screen completion
Piezometer
Screen interval

0 1 2 3 4
Scale in Miles

Source: Newmont, 1999c.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-16
SCHEMATIC HYDROLOGIC CROSS SECTION THROUGH PIT
(September 30,1997)

MINE AREA: SOUTH AREA	
DATE: 8/1/00	ACAD FILE: Fig4-16.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

In order to evaluate chemistry of the pit lake, Newmont commissioned a study that utilized existing chemical and hydrogeologic data in conjunction with field studies, laboratory tests and computer models (Geomega, 1997b). **The study was updated in 2001 based on the 1999 groundwater model data (Geomega, 2001).** The ultimate pit surface was characterized using a geologic block model. Six different units in the pit surface were defined; alluvium, carbonaceous siliceous refractory rock, sulfidic siliceous refractory rock, oxidized siliceous rock, oxidized carbonaceous rock, and unoxidized carbonaceous rock (**Figure 4-17**). Only the carbonaceous siliceous rock and the sulfidic siliceous refractory rock have predominantly negative net carbonate values, i.e., are potentially acid producing rocks. The acid producing potential of the carbonaceous siliceous rock is very small, however, it is very reactive and releases a greater mass of solutes into solution than the other units. For modeling purposes, the units were divided according to their net carbonate values and reactivity.

Humidity cell tests and field tests were conducted (Geomega, 1997b). The field tests were conducted in cells open to ambient precipitation and evaporation at the site. The field oxidation tests generated lower solute concentrations than the humidity cell tests. Chemical release functions were created from the humidity cell and the field tests. Chemical release functions show the concentration of a particular parameter in the leachate depending on time and on the net carbonate value of the leached rock. Both sets of data were used in the modeling. The oxidation of pyrite in the pit wall was estimated using the Fennemore-Neller-Davis model. Oxidation of pyrite leads to the generation of acid, and thus is an important factor in determining the pit lake chemistry.

The bulk pit lake chemistry was determined using the chemical release functions and the pyrite oxidation modeling results combined with the water inflow rates from the groundwater model. The bulk chemistry changes with time as the amount of leachate in the inflowing groundwater changes, and as solutes precipitate. The model PHREEQC (Parkhurst, 1995) was used to model the equilibrium chemistry of the pit lake, modeling geochemical reactions like sorption and precipitation. To assess the oxygen profile in the lake the model CE-QUAL-W2 (Cole and Buchak, 1995) was used.

The water of the Gold Quarry pit lake is predicted to be alkaline, containing levels of constituents which do not exceed **primary or secondary** enforceable drinking water standards **(Table 4-4)** (Geomega, **2001**). **Predicted concentrations of cadmium and selenium may exceed the 96-hour average aquatic life standard, but not the 1-hour average, and only molybdenum may exceed both standards (Geomega, 2001).** During the first years of pit refilling, 75 percent of the inflowing groundwater passes through the limestone in the base of the pit. Thus, the initial pit water has a large buffering capacity and neutralizes acidic inflows from the siltstone. **After initial filling, the** alkalinity is predicted to increase over time until it exceeds the **agricultural wildlife propagation standard in the mature lake** (Geomega, **2001**). **The benign water quality is attributable to the positive Net Carbonate Value limestone constituting the pit wall through which the inflowing groundwater enters the pit lake. Analysis of the pit lake chemogenetic pathway indicates an initial flush of oxidation products from the exposed wall rock, with most solute concentrations decreasing to minimum values after approximately 25 years due to chemical reactions with recharging**

groundwater and sorption/coprecipitation with biogenic solid phases.

The validity of the model results is supported by agreement with laboratory analog data (Geomega, 1997b). The predicted pit lake solute concentrations are also comparable to other Nevada pit lakes with good water quality (e.g., Miller et al., 1996; Davis and Eary, 1997; Shevenell et al., 1999).

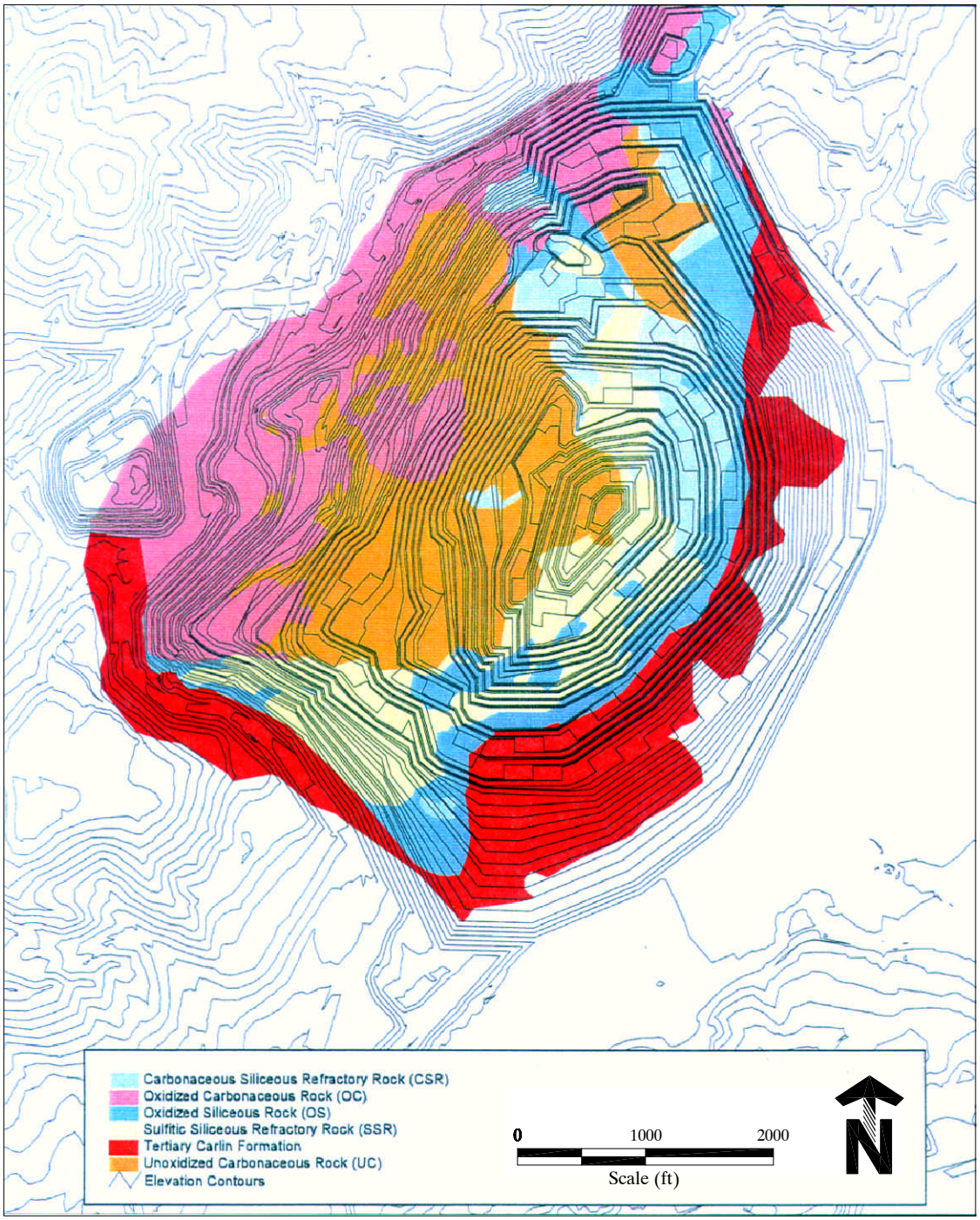
Constituent concentrations are at a maximum during the first years of pit refilling, when oxidation products are flushed out of the pit wall. These concentrations diminish with time, due to chemical reactions with recharging groundwater and removal by sorption and co-precipitation to amorphous ferric hydroxide.

Dissolved oxygen was predicted to range from approximately 7.5 to 11 mg/L. This is primarily due to low biological and chemical oxygen demand in the pit lake. The water would undergo complete mixing in fall and in spring. Predicted concentrations of manganese (**0.076** mg/L) **in the mature lake might exceed the voluntary secondary drinking water standard (0.05 mg/L), but not the mandatory secondary drinking water standard of (0.1 mg/L) (Geomega, 2001), and do not exceed any standards** in the juvenile lake (Geomega, 1997b). Predicted selenium concentrations (0.00**1** mg/L) **do not** exceed the 96 hour average aquatic life standard (0.005 mg/L) in both the juvenile and mature pit lakes, **and** they do not exceed drinking water standards (Geomega, **2001**). Predicted concentrations of mercury (<0.00**1** mg/L) **might** exceed the 96 hour average aquatic life standard of 0.000012 mg/L**,** but never the drinking water standard. However, mercury would exist primarily in the inorganic form**,** which is less toxic to aquatic organisms than organic methyl-mercury (Geomega, 1997b). Measurements of methylated mercury and inorganic mercury in three Nevada pit lakes (Anaconda, Aurora, and Boss pits) show that methyl-mercury is typically below detection levels (Geomega, 1997b).

The predicted final Gold Quarry pit lake composition and surrounding groundwater generally would be similar to or lower in dissolved metal concentrations than the pre-mining ore-zone groundwater (**Table 4-4**). The pit lake chemistry is similar to the pit lake chemistry previously analyzed (BLM, 1993) with certain exceptions barium, mercury and chloride would be lower; and manganese, potassium, and zinc would be higher. Alkalinity would also be higher.

Surface Erosion and Sedimentation

Erosion would occur in areas of increased surface disturbance at the South Operations Area Project Amendment. Sediment from these areas could accumulate in drainage ways and possibly in streams. Erosion is most likely to occur during heavy precipitation and runoff. Most drainage ways and streams in the mine area are ephemeral or intermittent and therefore would not carry increased sediment on a continuous basis. Impacts associated with accelerated erosion at the mine site are not likely to be major (Chapter 4, Soils, for additional information on erosion and soil loss). Newmont has developed a monitoring program and best management practices associated with EPA's stormwater regulations (codified at 40 CFR 122.26). The additional disturbance under the proposed action as compared to the currently approved action would not change the impacts due to erosion significantly.



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-17
ULTIMATE GOLD QUARRY PIT SURFACE LITHOLOGY

DATE: 6/6/00	ACAD FILE: Fig4-17.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

Source: Geomega, 1997b.

TABLE 4-4
COMPARISON OF GROUNDWATER AND PIT LAKE WATER QUALITY[1]

Parameter	Existing Gold Quarry Groundwater[2]	Quality of Two Existing Pit Lakes		Predicted Quality of Gold Quarry Pit Lake[5]			Drinking Water Standards[6] (primary standards)
		Kimbley Pit[3]	Yerington Pit[4]	Updated Flow Model	Gold Quarry Pit Lake	Predicted Range in 1993 EIS	
Aluminum	<0.10	NR	NR	0.022	0.026	0.017-0.037	-
Antimony	0.003	NR	NR	0.0047	0.008**1**	NR	0.006
Arsenic	0.099	<0.180	0.014	0.029	0.025	0.028-0.043	0.05
Barium	0.090	0.009	0.034	0.014	0.014	0.032-0.033	2.0
Cadmium	<0.005	<0.007	0.008	0.0018	0.001**4**	<0.001	0.005
Chloride	17.0	264	40	167	117	8.7-8.8	400.0 (S)
Chromium	<0.002	<0.010	0.02	0.0057	0.005	0.006-0.025	0.1
Copper	<0.005	0.172	0.232	0.0095	0.004	0.001-0.003	1.3
Fluoride	0.64	2.61	1.4	0.67	0.637	NR	4.0, 2.0 (S)
Iron	0.12	0.455	0.581	<0.001	<0.001	<0.001-0.001	0.3, 0.6 (S)
Lead	<0.002	<0.050	0.012	<0.001	<0.001	<0.001	0.015
Magnesium	16.6	NR	22.3	29	29.**0**	23.3-23.4	125/150 (mun/dom)
Manganese	0.013	0.31	0.076	0.076	0.194	0.13-0.15	0.05, 0.01 (S)
Mercury	0.0004	0.838	<0.001	<0.001	<0.001	0.002-0.003	0.002
Molybdenum	0.1	NR	NR	0.103	0.114	NR	-
Nickel	0.01	NR	NR	0.08	0.075	NR	0.1
Potassium	7.8	NR	6.9	16	15.5	4.86-4.91	-
Selenium	0.059	<0.130	<0.002	0.01	0.008	0.006-0.011	0.05
Silver	<0.005	<0.020	<0.010	0.003	0.007	0.005-0.006	0.05
Sodium	90.0	NR	74	44	34.9	7.6-7.8	-
Sulfate	63	1,607	242	144	156	69-99	250,500 (S)
Thallium	0.**1**	NR	NR	0.0012	0.001	0.025-0.028	0.002
Vanadium	0.1	NR	NR	<0.001	0.00185	NR	-
Zinc	0.018	2.43	0.081	0.034	0.038	0.011-0.049	5.0 (S)
pH (SU)	7.3	7.59	8.21	8.0	7.8	7.96-8.31	6.5 - 8.5 (S)
Alkalinity	224	NR	110	290	290	24-52	

Source: PTI, 1992; Geomega, 1997b **and 2001**, NAC 445.117.

1 Concentrations are reported in milligrams per liter (mg/L), except pH which is in standard pH units (SU); NR = results not reported.

2 Well GQTW-4, screened in the Gold Quarry siltstone ore zone. Sample collected 7-15-91.

3 Kimbley Pit Lake, Ruth, Nevada. Sampled 9-24-91 (MacDonald, 1992).

4 Yerington Pit Lake, Yerington, Nevada. Sampled 10-29-90 (MacDonald, 1992).

5 Predicted Gold Quarry pit lake chemistry at equilibrium **(250 years)**.

6 All concentrations reported are primary drinking water standards unless followed by (S) indicating secondary standards, or (mun/dom) indicating municipal and domestic standards.

Mine Processing Impacts

Other impacts on water resources could occur in the South Operations area as a result of spills of lubricants, fuels, solvents, and cyanide onto the ground surface and into drainage ways; and seepage of cyanide into the subsurface from the leach pads and tailing impoundment. Impacts from direct mining activities would continue for a longer time under the Proposed Action than under the prior approval (BLM, 1993). Seepage of cyanide would pose a somewhat increased threat due to the larger volumes of leach ore and tailing.

The tailing impoundment is designed to contain a 100-year/24-hour storm. Failure of the tailing embankment would be highly unlikely based on design, operation, and monitoring. Storage of storm water in the tailing impoundment and potential failure of the tailing embankment was analyzed in the Mill 2/5 Tailing Storage Facility Environmental Assessment (BLM, 1991).

The existing Non-Property Leach Pad would be extended and Property Leach Pad 2 would be constructed. The Refractory Leach and bio-leach Facilities would also be expanded. Solutions containing cyanide and metals that are discharged to or utilized at the tailing impoundment and leach pads would be contained in the multiple-lined facilities, would be neutralized, and reclaimed. Releases during mine operation would be detected by monitoring wells and subsequently corrected. Waste rock and natural soils can attenuate some heavy metals and cyanide (BLM, 1991).

Cyanide Fate

Cyanide process solutions are in use throughout the gold recovery process. These solutions are present in the tanks and piping associated with the mill, lined ponds associated with the heap leach facilities, and in the heap leach and tailing disposal facilities. Newmont's reclamation plan includes provisions to neutralize and detoxify all cyanide solutions. All rinsate, residual liquor, and rain/snowmelt would be collected from the spent oxide heaps following completion of detoxification and neutralization procedures for disposal through evaporation. At this point in time, all solutions should be at or below the water quality criteria so that all process ponds, all transfer ditches/canals, and the tailing impoundment would serve as evaporation ponds. These activities would occur in accordance with NDEP regulations.

Cyanide is a highly reactive and relatively unstable compound. Its toxicity is directly related to the amount of cyanide ion (CN^-) and hydrogen cyanide (HCN) present in the solution. Neutralization and detoxification occur through chemical processes that volatilize hydrogen cyanide, bind the cyanide ion in stable nontoxic compounds, or otherwise degrade the cyanide into nontoxic constituents. Chemical agents such as chlorine, hypochlorite, or others may be used to accelerate these processes, but the proposed method consists of adding water to reduce pH and allowing exposure to air and sunlight to accelerate the degradation processes.

Reducing pH of the cyanide-bearing solution is the primary method of neutralization and detoxification. Cyanide remains in solution only under alkaline conditions (pH greater than 9). As the pH is reduced through introduction of fresh water, the cyanide is converted to hydrogen cyanide gas and slowly released to the atmosphere.

Cyanide neutralization and detoxification at the tailing storage facility and leach pads would begin as soon as the facilities are

removed from service. Residual water in the tailing storage facility would evaporate or seep through the tailing material to the underdrain system. Seepage would be collected in the seepage collection pond and treated to meet State of Nevada standards (0.2 mg/L weak acid dissociable cyanide and a pH between 6 and 9 standard units). In the arid environment of the mine site, it is expected that continuous seepage of residual tailing solution would cease approximately seven years after tailing deposition is halted. It is estimated that approximately 15 gpm (0.03 cfs) seepage from infiltrating precipitation may continue to discharge from the underdrain system of the tailing impoundment (BLM, 1993). This water may contain minor amounts of cyanide, but concentrations would be lower than the regulatory limit. Cyanide at these concentrations would not be expected to impact the environment and any residual cyanide concentrations would continue to decline over time through exposure to air and sunlight.

Cyanide solution in the leach pads would be neutralized and detoxified by recirculation and evaporation. Fresh water would be introduced onto the leach pads to rinse residual cyanide from the spent ore. The rinse water would be recycled through the leach pad until it meets the regulatory criterion described above. At that time, all rinse water would be collected and disposed through evaporation. If freshwater rinsing does not meet State of Nevada standards, additional neutralization techniques would be utilized. These actions are the same as analyzed in the original EIS (BLM, 1993).

Ammonium Thiosulfate Fate

Newmont would expand the Refractory Leach Facility to provide an ammonium thiosulfate leach pad for heap leaching the carbonaceous refractory ore in lifts without removing it from the pad. At closure, the ammonium thiosulfate leach facility would be drained down, and rinsed, and all remaining solutions disposed of by evaporation. The basic approach is to apply rinse water until the ammonium thiosulfate breaks down to benign levels. The ammonium thiosulfate will break down into ammonia gas and various recombined sulfates (salts). Continued rinsing will reduce the sulfates. If rinsing does not meet the State of Nevada standards for final seepage solutions, additional neutralization techniques would be investigated, in consultation with the BLM.

Alternatives

Potential impacts from either of the two action alternatives would be very similar to those of the Proposed Action, but with small specific differences. There would be no differences in impacts from the dewatering system. The potential drawdown would be the same for both action alternatives, so the potential effects on springs/seeps, wells, surface stream flows, water temperatures, and water quality would be expected to be the same. If 2 percent of the waste rock was placed in the Mac pit, there might be a proportionate reduction in surface erosion from waste rock disposal facilities.

No Action Alternative

The No Action Alternative would result in those impacts on water resources that have been stated in the original EIS (BLM, 1993). The same kinds of effects were identified in 1993 as were discussed in this document. No further impacts would occur following cessation of mining in 2001.

Dewatering effects were predicted to occur in a drawdown area of 151,600 acres in 1993, compared to a predicted drawdown area for

SOAPA of 177,700 acres. Dewatering effects would cease in 2001 under No Action and 2011 under the Proposed Action.

Potential Mitigation and Monitoring

The monitoring program for SOAPA will be based on a revised mitigation and monitoring plan. The revised plan is currently being formulated between the BLM and Newmont based on newly predicted potential impacted areas. BLM and Newmont will jointly decide upon the need for and location of any additional monitoring wells, spring and seep sites, and surface water stations. A revised Mitigation and Monitoring Plan is currently being developed andwill be included in the Final EIS and Record of Decision. Mitigation measures would likely be the same as specified in the 1993 plan (BLM, 1993) including:

Groundwater Sources
- Replacement wells or other water source of equivalent yield and quality.
- Subordinate any baseflow losses with Newmont's senior irrigation water rights, if necessary.
- Any groundwater quality problems would be evaluated for potential source and remedied using best available technologies.

Springs and Seeps
- Replace lost flows or substitute water sources at nearby locations with wells, guzzlers, or other measures.
- Any spring or seep quality problems would be evaluated for potential source and remedied using best available technologies.

Streams and Rivers
- Newmont would augment **certain** flow reductions in Maggie, or Susie creeks or **certain of** their tributaries using the mine dewatering system, impounded runoff water, senior irrigation water rights or from new wells **as described in the current Mitigation Plan, pages 32-34**.
- Any surface water quality problems would be evaluated for potential source and remedied using best available technologies.

Stream Channel Stability
- Seasonal maintenance of **any probelm areas as described in** the current channel stabilization program.

Irreversible and Irretrievable Commitment of Resources

During the life of the South Operations Area Project, approximately 600,000 acre-feet of groundwater would be removed cumulatively by the dewatering system, which is approximately 100,000 acre feet more than under the currently approved operations. A portion of this water would be consumed at the mine site and the remaining water would be discharged into Maggie Creek. Therefore, most of the water would be removed from the Maggie Creek Basin but would be retained in the Humboldt River Basin with the ultimate destination being the Humboldt and Carson sinks. Dewatering would expand the cone of depression and reduce or result in the loss of some stream and spring/seep flows in the vicinity of the mine. The likelihood of impacts on springs or seeps is related to proximity to the mine. The groundwater removed and transported to the Humboldt and Carson sinks is irretrievable. The groundwater drawdown is essentially a reversible effect in the Maggie Creek Basin region.

Residual Effects

Successful implementation of mitigation measures would eliminate most residual effects on water resources. Continued dewatering discharges until 2011 may increase the total load of metals and trace elements to the Humboldt River, and ultimately to the Humboldt Wildlife Management Area, even though all discharges comply with water quality standards. The Gold Quarry pit would continue to be a source of groundwater loss through net evaporation at a maximum rate of approximately 1,117 acre-feet per year (690 gpm). Long-term quality of water in the Gold Quarry pit lake and surrounding groundwater is predicted to be similar to or better than existing groundwater quality. Some produced water would infiltrate from the Maggie Creek Ranch Reservoir, and some would be used for irrigation at the Hadley fields. Drawdown of groundwater and reductions in stream and river baseflows would slow and begin to approach pre-mining conditions in most streams after dewatering ceases. Although this period of recovery could extend up to 100 years, most recovery would occur within about 20 years after cessation of dewatering. Modeling of cumulative impacts from pit lake in the area predicts that baseflow of the Humboldt River may be permanently lowered by 1 cfs. Successful mitigation of springs and streams generally is unproven technology; should mitigation fail, residual effects would result.

FLOODPLAINS

Direct and Indirect Impacts

Proposed Action

Between Palisade and Rye Patch Reservoir, the Humboldt River has an average annual loss, so the addition of mine discharge water to the Humboldt River would temporarily help offset the natural reduction in baseflow downstream of Palisade. **Figure 4-13** is a representative cross-section showing mine discharge water plotted with baseflow and bankfull flow in the Humboldt River immediately downstream from the Maggie Creek confluence. The figure also indicates the flood prone level in the river. The flow increase from mine discharge in the Humboldt River would be well within the active channel for low and moderate flows, and would be undetectable during high flows. It is, therefore, also expected that mine discharge-induced flow increases would have an undetectable effect on the Humboldt River floodplain.

Alternatives

The effects on Humboldt River floodplains from either of the alternatives would be the same as for the Proposed Action.

No Action Alternative

There would be no impacts on Humboldt River floodplains different than those already occurring if the No Action Alternative were implemented. The magnitude of impacts would be slightly different in that mining discharge flows would be lower than those analyzed in 1993, but baseflow reductions during the post-mining period could be greater.

Potential Mitigation and Monitoring

No mitigation or monitoring of floodplains is proposed.

Irreversible and Irretrievable Commitment of Resources

There would be no irreversible or irretrievable effects on floodplains if the Proposed Action or alternatives were implemented.

Residual Effects

No residual effects are expected on Humboldt River floodplains.

SOILS

Impacts on soil resources are directly related to acreage of disturbance. All alternatives would have a similar impact on soils as the Proposed Action. Comparison of impacts for the Proposed Action and alternatives was conducted using the same mitigation and reclamation procedures for all actions.

Direct and Indirect Impacts

Proposed Action

Primary impacts on soil resources would include soil loss and reduction in productivity as a result of soil salvage, stockpiling, and redistribution during reclamation.

Impacts to soil resources were analyzed in detail by the BLM (1993). For the most part, impacts would be the same within the areas of new disturbance for SOAPA. Following is an evaluation of soils impacts specific to areas of new disturbance which differ from impacts analyzed in 1993.

In order to determine if a sufficient quantity of topsoil and useful subsoil would be available for reclamation, acreages of each soil type identified within the new disturbance areas were calculated (**Table 4-5**). The average estimated depth of salvageable soil for each soil mapping unit within each of the five areas was then used to calculate the soil available for respreading. As shown in **Table 4-5**, the available volumes for each area are more than adequate to respread stockpiled soil to the 6-inch depth proposed in the reclamation plan.

Water erosion potential and resulting soil loss were quantified for areas of new disturbance using the Revised Universal Soil Loss Equation (RUSLE) (Renard et al., 1997) (**Table 4-6**). Annual soil loss in tons per acre per year was calculated for each of the five areas of new disturbance associated with SOAPA. Soil loss was computed under two scenarios. The first (listed in **Table 4-6** as "nonvegetated") assumes highly disturbed soil conditions with little or no vegetative cover.

The second (listed in **Table 4-6** as "vegetated") assumes that reclamation is nearing completion with vegetative cover at expected density (Westech, 1992). **Table 4-6** indicates that soil losses due to water erosion are predicted to range between 10.4 and 20.3 tons/acre/year under the nonvegetated scenario.

Such losses would exceed maximum tolerable limits during the period between soil redistribution and successful reclamation. According to the USDA (1993), the maximum tolerable soil loss varies between one and five tons/acre/year depending on depth of the soil to unfavorable substrata. However, once revegetation is reestablished, losses would be 0.51 tons/acre/year or less.

Alternatives

The action alternatives would have direct and indirect impacts similar to the Proposed Action. Any differences in impacts would be

TABLE 4-5
DISTURBANCE ACREAGE, DEPTH OF AVAILABLE SOIL, AND TOTAL AVAILABLE SOIL VOLUME

Soil Mapping Unit	Mapping Unit Symbol	Acres	Soil Salvage Depth (inches)	Soil available for respreading (yds^3)	Soil needed for respreading (yds^3)
Northwest end of Gold Quarry North WRDF and adjacent diversion:					
Bucan, 15-30% slopes	BU	124.03	18	300,153	
Malpais-Rock Outcrop, 50-75% slopes	MR	36.44	0	0	
Total for area		160.47		300,153	129,446
Southwestern portion of James Creek WRDF:					
Puett, 15-30% slopes	PT	6.20	12	10,003	
Susie Creek, 4-15% slopes	SC	67.37	18	163,035	
Total for area		73.57		173,038	59,346
Southwestern portion of Gold Quarry South WRDF and adjacent diversion:					
Cherry Spring, 2-8% slopes	CS	3.91	24	12,616	
Orovada, 4-15% slopes	OR	9.99	18	24,176	
Pie Creek, 15-30% slopes	PK	155.50	6	125,437	
Puett, 15-30% slopes	PT	63.98	12	103,221	
Total for area		233.38		265,450	188,260
Ancillary Leach and adjacent portion of refractory ore stockpile					
Berning, 30-75% slopes	BE	6.16	0	0	
Cherry Spring, 2-8% slopes	CS	86.68	24	279,720	
Puett, 15-30% slopes	PT	18.99	12	30,637	
Total for area		111.84		310,357	90,218
Property Leach Pad 2 and southern portions of Refractory Leach Facility Expansion and Non-Property Leach Pad Expansion					
Cherry Spring, 2-8% slopes	CS	628.17	24	2,026,895	
Orovada, 4-15% slopes	OR	50.10	18	121,242	
Puett, 15-30% slopes	PT	77.59	12	125,179	
Total for area		755.86		2,273,316	609,727

TABLE 4-6
SOIL LOSS TO WATER EROSION BY DISTURBANCE AREA

		Leach Pads & Waste Rock Piles		Soil Stockpiles	
		Non-vegetated	Vegetated	Non-vegetated	Vegetated
Percent slope		43	43	40	40
Maximum slope length (ft.)		116	116	130	130
Slope length & steepness factor		7.8	9.0	7.6	8.9
Cover factor		.45	.013	.45	.013
Northwest end of Gold Quarry North WRDF & adjacent diversion	k factor	.30	.30	.30	.30
	soil loss/tons/ac/year	12.2	.30	12.0	.30
Southwestern portion of James Creek WRDF	k factor	.26	.26	.26	.26
	soil loss/tons/ac/year	10.5	.26	10.4	.26
Southwest portion of Gold Quarry South WRDF & adjacent diversion	k factor	.35	.35	.35	.35
	soil loss/tons/ac/year	14.2	.35	14.0	.35
Ancillary Leach & adjacent portion of refractory ore stockpile	k factor	.50	.50	.50	.50
	soil loss/tons/ac/year	20.3	.51	20.0	.49
Property Leach Pad 2 & southern portions leach facilities expansions	k factor	.50	.50	.50	.50
	soil loss/tons/ac/year	20.3	.51	20.0	.49

negligible because the alternatives would disturb an area of six and 53 acres less than the Proposed Action, respectively.

No Action Alternative

The No Action Alternative would not create any new disturbance from soils. Newmont would continue their current soil salvage and mitigation program as part of the approved Reclamation Plan. The No Action Alternative has, or would, disturb 7,960 acres, while the Proposed Action would disturb 1,392 additional acres.

Potential Mitigation and Monitoring

Newmont would continue to implement mitigation measures to control surface erosion and sedimentation as was described under mitigation for water resources. Newmont would further mitigate impacts to the soil resource by continued implementation of their reclamation plan, including enhanced reclamation techniques. Included in the plan are the creation and stabilization of topsoil stockpiles, the creation and monitoring of vegetation test plots, the spreading of topsoil

after facility sites are closed, and the revegetation of the site.

Three of the five enhanced techniques would not be implemented until operations cease (landscape considerations, raptor habitat enhancement, and establishment of diversified ecosystems). Two of the enhanced reclamation techniques are being implemented on a concurrent basis (topsoil management plan and intensified test plot program). The topsoil management plan has proven effective in salvaging and protecting topsoil. The intensified test plot program is continuing to generate data that will be useful during final reclamation.

Irreversible and Irretrievable Commitment of Resources

The projected soil losses during operations are irretrievable and irreversible. Following revegetation, soil losses would be reduced to acceptable minimum levels or better.

Residual Effects

Physical and chemical disruption of soil by salvaging and stockpiling would constitute a loss of soil productivity. This loss is, however, largely reversible over time by natural soil development. Reclamation steps such as grading, spreading topsoil, and revegetation expedite this process, but soil rebuilding requires many years. If reclamation is not successful, these impacts would be extended in time.

VEGETATION

The Proposed Action would disturb an additional 1,392 acres of vegetation, primarily lower elevation sagebrush-bunchgrass community types in deteriorated range condition. (Disturbance has already occurred on 7,960 acres.) While reclamation would restore much of the disturbed area, some features (e.g., mine pit) could not be reclaimed. It is the intent of reclamation to restore a functional plant community that would include adequate cover and diversity to provide for post-mining land uses. Reclamation will, however, have to provide comparable plant cover to undisturbed reference areas in order to be judged acceptable by BLM. The process of future re-colonization could then increase the percentage of plant cover and plant diversity in the future.

Direct and Indirect Impacts

Proposed Action

The Proposed Action would have direct, indirect and cumulative impacts on the vegetation resources within the project area. Surface disturbances associated with expansion activities are anticipated to avoid wetland and riparian environments, and only impact upland vegetation. However, these wetter communities may be impacted by the changes to the hydrologic regime caused by pit dewatering.

Direct impacts to upland vegetation would occur as a result of the construction of the proposed facilities and would continue during their operation. Specifically, the construction of the proposed facilities would eliminate 1,392 acres of native vegetation. Acres of disturbance by facility are provided in **Table 2-6**. This physical disturbance would remain during the life of the operation, and is considered short-term. Upon closure of the mine, vegetation coverage would be replaced at the SOAPA facilities by reclamation activities. By returning the vegetative cover to

the landscape, reclamation would mitigate most impacts to the area caused by the proposed physical disturbance. Despite reclamation activities, vegetation resources within the proposed disturbance area would incur some long term impacts. It is not anticipated that the revegetation process would restore the species diversity or species composition of the preexisting plant community, and thus these two values would be impacted **for the long term**. Natural restoration of these values could occur over extensive periods of time.

Indirect impacts to upland vegetation would also occur as a result of the Proposed Action. These impacts would arise from the direct impact of vegetation removal necessary for the construction and operation of the facilities, and would affect undisturbed as well as disturbed vegetation in several ways. First, vegetation removal would increase fugitive dust levels, which in turn would inhibit photosynthesis and transpiration processes. Second, the potential for erosional features would increase, hindering rooting success. Finally, the potential for weedy species to invade and become established would increase. This impact would likely be problematic indefinitely due to the nature of weed invasions (see section on Noxious Weeds, below).

Accidental spills of leaching agent and/or pregnant solution are not anticipated to impact vegetation resources for the following reasoning. Accidental spills could occur either in transport or on-site and would be immediately addressed by Newmont's Spill Prevention, Control, and Countermeasures plan. Onsite, accidental spills would not come into contact with vegetation, and clean up would insure that soil and water were decontaminated. Spills that occur during transport would be treated in a similar manner, decontaminating soils and water to ensure no future contamination. If vegetation was impacted or removed as a result, effects would be restored by revegetation.

Alternatives

The alternative of backfilling the Mac pit would result in approximately 40 more acres of revegetated area than the Proposed Action. By placing waste rock in the Mac pit, the waste rock disposal facilities would be slightly smaller. It is estimated the WRDFs would be six acres smaller. The alternative of modifying the WRDFs would provide approximately 53 acres less disturbance than the Proposed Action. This would be accomplished by building the WRDFs taller instead of broader.

No Action Alternative

The No Action Alternative would have no additional kinds of impacts on vegetation beyond those described under already approved, current operations. Disturbance would, or has, occurred on 7,960 acres while the Proposed Action would disturb an additional 1,392 acres.

Potential Mitigation and Monitoring

No additional mitigation is proposed beyond implementation of the approved Reclamation Plan of 1993, as amended in 1996, March 1997, and December 1997. Part of that plan includes the monitoring of test plots for revegetation success. The test plot program is designed to identify the optimum combination of topsoil depth, soil amendments, and plant species. The test plots have already proven effective in aiding concurrent reclamation.

Off-site mitigation has been provided by Newmont for vegetation lost from the pit area for both existing operations and SOAPA (1,000 acres) by seeding areas at Bob's Flat and Dunphy Hills (6,566 acres).

Irreversible and Irretrievable Commitment of Resources

There would be an irreversible commitment of potential vegetative productivity in the loss of 139 acres taken by the Gold Quarry pit expansion. There would be an irretrievable loss of vegetative productivity on the areas where new facilities are constructed until reclamation is complete. Either of the action alternatives would also have similar irretrievable losses of vegetative productivity from facility sites, but the Mac pit backfill alternative would result in approximately 40 fewer acres of land irretrievably lost to any continued surface uses. The modified WRDF alternative would result in approximately 53 fewer acres to be irretrievably lost in comparison to the Proposed Action.

Residual Effects

Residual effects of the Proposed Action and alternatives would be determined by the success of reclamation. When reclamation success is achieved, there would be no residual effects on vegetation.

NOXIOUS WEEDS

Direct and Indirect Impacts

Proposed Action

This section provides a description of the potential for the establishment and spread of noxious weed communities within the project area and within the study area as an environmental consequence of the Proposed Action. Soil disturbance plays a significant role in opportunities for the establishment of noxious weeds. The proposed project would involve the disturbance of 1,392 acres of vegetation through mining activities, removal of waste rock to disposal facilities, and the construction and use of ancillary facilities (including roads, yards and linear corridors). In addition, the dewatering process is predicted to result in reduced or eliminated baseflow of five springs in the area. This change in the hydrologic regime can be expected to affect the wetland plant species in and around the springs, and if drier conditions occur, they could open up habitat for weed establishment.

Noxious weeds are not equal in their potential for effects, therefore the weeds of concern should be addressed individually as to potential for effects and options for mitigation and/or control measures.

The three plants identified as dominating the weed infestations currently found on mine facility sites are particularly tenacious due to individual habits. For example, Scotch thistle seeds can be viable for over 30 years (BLM, 2000c), and so, though buried and unable to germinate for years, can, once uncovered, lead to a new infestation. Saltcedar likewise can propagate from buried or submerged stems. The salts which accumulate in the plant can leach from the plants and, if present in large quantities, can result in a saline soil. This soil can, in turn, impede the establishment of desirable vegetation.

The weed survey of 1998 (JBR, 1998) indicated weed infestations on approximately

101 acres at the South Operations area. The Proposed Action would reduce several of the infested sites, by removing them or covering them. The expansion of the Gold Quarry North WRDF would eliminate approximately 43.5 acres of scotch thistle. The removal of the James Creek tailing facility would remove 0.34 acres of scotch thistle, some Canada thistle, and several hundred saltcedar plants. The expansion of the James Creek and Gold Quarry South WRDFs would eliminate approximately 1.1 acres of scotch thistle. The scotch thistle infestations in Section 18 would all be eliminated as well.

These removal effects would be countered to some unknown degree because all of the new areas disturbed for construction would present new sites for invasion (1,392 acres). It is reasonable to assume that some new sites of weed invasion would occur. Newmont's weed control program would implement controls on any new infestations and reduce the potential for impacts by any new infestations.

Alternatives

The potential impacts from either of the Action Alternatives would be expected to be very similar to those described for the Proposed Action, as the alternatives would also expand the same facilities, disturb a similar amount of ground, construct similar ancillary facilities, and the volumes of materials moved would be the same as the Proposed Action.

No Action Alternative

If the No Action Alternative were implemented, there would be no new impacts resulting beyond those already in effect. The existing noxious weed community would not be expected to appreciably increase because of no new disturbance, and thus no new sites for invasion areas would be created. Newmont's current weed control efforts would be continued for the life of the mine and the reclamation period.

Potential Mitigation and Monitoring

Newmont conducts annual weed surveys, and these would be continued. Information from these surveys is used to direct weed control efforts. Monitoring and weed control would continue until reclamation was complete.

Irreversible and Irretrievable Commitment of Resources

Where weed infestations are significant, they represent an irretrievable commitment of range productivity. During mining operations, the infestations on the mining property are not preventing utilization of the range because cattle are not allowed to graze on the property. If noxious weeds are not controlled during reclamation, then the loss of range productivity would occur after mining and reclamation is complete.

Residual Effects

The goal of noxious weed control is eradication. Some noxious weeds may remain on the site after mining and reclamation are completed. If there is a continued presence of noxious weeds after the mining operation is finished, it would represent a long-term reduction in range productivity.

RIPARIAN, WETLANDS, AND WATERS OF THE U.S. AREAS

Direct and Indirect Impacts

Proposed Action

The Proposed Action would have direct, indirect and cumulative impacts on the waters, wetland, and riparian resources within the incrementally expanded project area. No wetlands would be directly impacted by the placement of dredge or fill material in wetlands as defined and regulated by the U.S. Army Corps of Engineers. **Based on the 1993 jurisdictional survey, the Proposed Action was projected to impact 0.98 acres of Waters of the United States in Section 18, which consisted of an unnamed drainage of non-wetland waters that convey snowmelt and precipitation runoff across Section 18 on its way to entering Maggie Creek. On January 9, 2001, the U.S. Supreme Court issued its decision in Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers, which invalidated part of the regulatory definition of Waters of the United States. Given that decision, it is possible that certain of these previously identified waters are not jurisdictional. Thus, the prior delineation represents the maximum acreage of jurisdictional waters that may be affected. To the extent those waters still qualify as Waters of the United States, a 404 permit would be obtained from the Corps of Engineers, prior to construction of facilities that would impact those waters. All action alternatives would have impacts on wetlands and Waters of the U.S. similar to that of the Proposed Action.**

It is anticipated that the Proposed Action would potentially impact **limited** riparian and wetland areas along **middle and lower** Marys **Creek**, **lower Maggie Creek,** and lower Fish Creek.

The drawdown contour also encompasses five spring and seep sites with about 2.5 acres of associated riparian habitat beyond those analyzed in 1993. All other springs and seeps encompassed by the expanded drawdown contour are located in mountain spring domains and thus are not predicted to be affected by mine dewatering. The kinds of impacts to wetland and riparian areas potentially caused by the dewatering activities are anticipated to be similar to those already documented in the 1993 EIS, e.g., vegetation composition could be modified for wetter species to drier area forbs, riparian acreage could be diminished, productivity could be reduced, and erosion could increase.

With reduction or loss of flows, species composition would be modified and acreage of riparian types diminished. Wetter site species would be replaced by species typical of the remnant riparian vegetation type. Site productivity would be decreased, resulting in lower value for livestock grazing and wildlife habitat. Streams potentially impacted include the following.

Maggie Creek. Riparian areas along Maggie Creek were fully analyzed in the South Operations Area Project EIS (BLM 1993). **That EIS indicated that s**ome riparian wetland and non-wetland vegetation could be indirectly affected by the SOAP. **However, the Mitigation Plan that was implemented in 1993 has been effective in providing improved conditions in the riparian and wetland habitats along Maggie Creek (Appendix A).** A qualitative assessment of potentially affected riparian areas can be seen on **Figure 4-18.**

With reduced flow, plant composition would be shifted toward species less dependent on water. Specific changes in wetland and riparian vegetation would depend on the magnitude and duration of flow reduction and the degree to which flows depend on unaffected water sources.

Marys Creek. Marys Creek supports riparian and wetland vegetation. **Most of t**he upper reaches are not expected to be impacted because baseflows are related to perched springs in the Marys Mountain spring domain. Wetland vegetation and riparian zones from the Carlin "Cold" Springs to the Humboldt River could, however, be impacted by predicted flow reductions at Carlin Springs. About one mile of stream has riparian and wetland vegetation in an area potentially impacted by the incremental expansion of the 10 foot drawdown contour.

Simon Creek. Simon Creek was analyzed in the South Operations Area Project EIS (BLM 1993). Hydrologic modeling in 1999 indicated that lower Simon Creek would be outside the 10-foot drawdown contour, while the headwaters would still be within the contour line.

Fish Creek. Fish Creek supports a limited amount of riparian vegetation**. The creek** would not be substantially affected by dewatering since it is primarily within the Independence Mountain spring domain**, but a spring in the lower reach could potentially be dewatered. If so, then riparian areas along the lower reaches might experience some effects from reduced flow. Lower Fish Creek is an intermittent stream.**

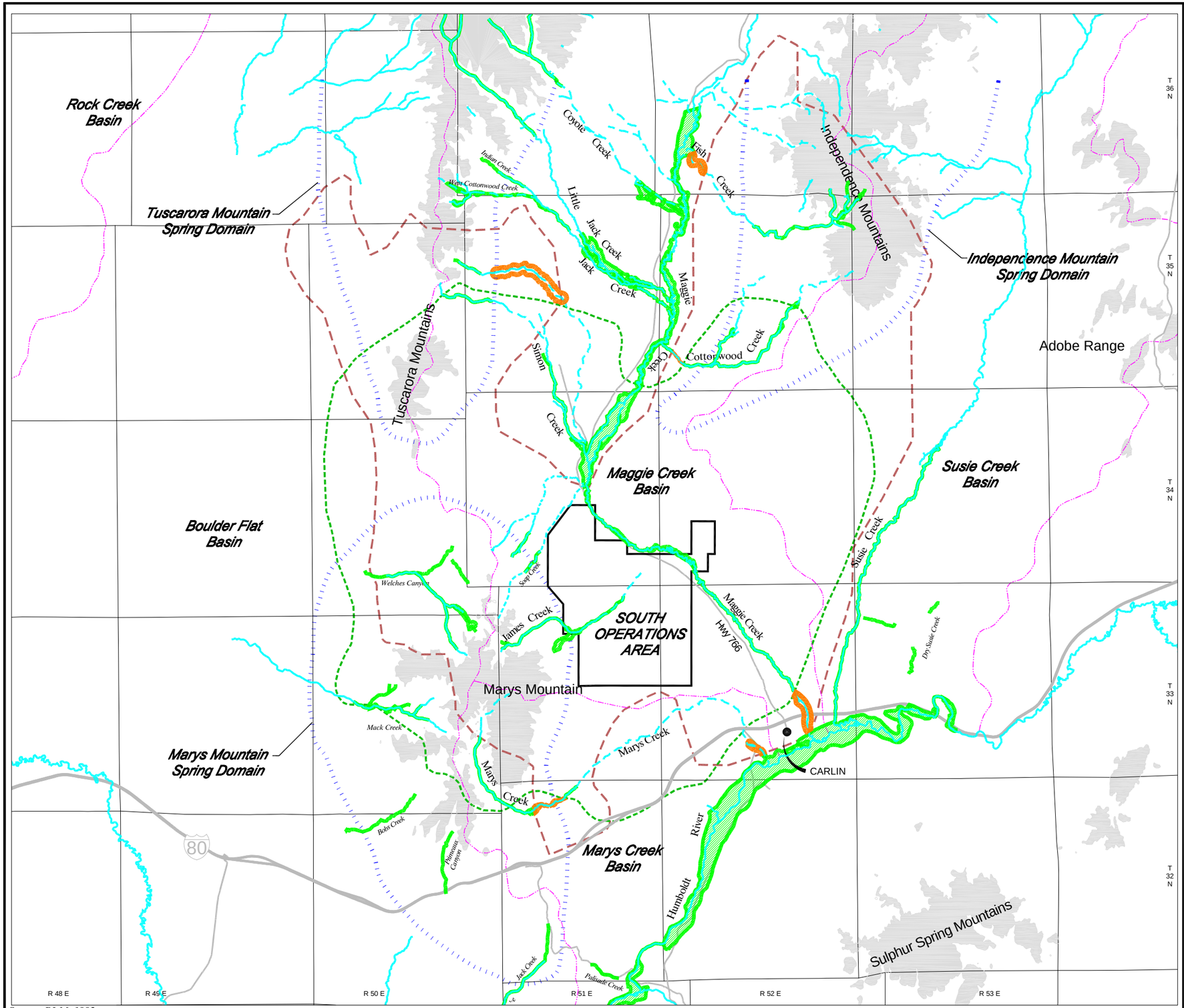
Humboldt River. Potential effects on the Humboldt River riparian areas were disclosed in the South Operations Area Project EIS (BLM 1993). The same kinds of impacts would still be expected to occur, however, the analysis in 1993 was based on dewatering discharges of up to 42,000 gpm, but current analysis is based on less than 30,000 gpm. Therefore, potential impacts on riparian and wetland areas along the Humboldt are expected to be reduced below those disclosed in 1993.

Alternatives

Potential impacts to wetlands or riparian areas from either of the two action alternatives would be the same as those of the Proposed Action.

No Action Alternative

If No Action was selected, then potential impacts to five spring/seep wetlands would not occur, however, 25 spring/seep wetlands would be affected as approved under the existing South Operations Area Project. Streamflow would continue to be affected in Maggie and Marys creek basins and their tributaries, thus maintaining existing conditions for streamside wetlands. Additionally, under No Action, wetlands and riparian areas in lower Maggie Creek and along the Humboldt River would continue to experience augmented flows through 2001, and they would be exposed to lower base flows following the year 2001 as groundwater seeks to return the cone of depression to pre-mining levels.



Source: BLM, 1993

LEGEND

- 1999 Predicted 10ft Drawdown Contour
- 1993 Predicted 10ft Drawdown Contour
- Hydrologic Basins
- Perennial Streams
- Intermittent Streams
- Spring Domains
- Riparian Areas
- Riparian Areas Predicted to be Impacted *(which were previously identified in the 1993 EIS)*
- Mountain Ranges

NOTES:

(1) Not all riparian areas are located directly in current active stream channels.
(2) Riparian areas located within mountain spring domains are not considered to be impacted.
(3) Additional riparian areas along the Humboldt River between Maggie Creek and Palisade would be impacted, but are not shown within the predicted impact area.

N

0 1 2 3 4 5 6

Scale in Miles

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-18 PREDICTED IMPACTED RIPARIAN AREAS

MINE AREA: SOUTH AREA	
DATE: 02/23/01	ACAD FILE: Reports/Fig4-18.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

Potential Mitigation and Monitoring

Continue implementation of the Maggie Creek Watershed Restoration Project. The project has been very effective in improving stream and riparian habitats within the Maggie Creek Basin. Additional information was provided in the Chapter 3 section on Riparian and Wetland Areas and Threatened, Endangered, Candidate and Sensitive Species. Also see **Appendix A** for a monitoring analysis of the Maggie Creek Watershed Restoration Project and "before" and "after" photographs of Maggie and Coyote creeks. However, some revision is needed for the Maggie Creek Watershed Restoration Project in terms of increasing flexibility in the grazing prescriptions and in refining biological standards. A few provisions of the Project including fencing on Susie Creek and a Conservation Easement will need to be completed.

New proposals for mitigation of riparian areas have not been made in light of the extensive monitoring and mitigation activities ongoing for streams and springs/seeps, which, if successfully implemented, should also serve to maintain riparian areas. However, if additional areas require monitoring or mitigation, then additional measures can be negotiated as part of the Mitigation and Monitoring Plan to be developed as part of the Record of Decision for this project. Potential sites identified by the BLM include the lower Jack Creek area and the hot springs wetlands (Spring #24).

Irreversible and Irretrievable Commitment of Resources

Successful mitigation and eventual recovery of the hydrologic system would **offset** wetland and riparian area degradation or loss. Losses would be irreversible only if the hydrologic conditions do not return to pre-mining conditions, or if the mitigation measures that Newmont has committed to (baseflow replacement or augmentation of springs, seeps, or stream reaches) prove inadequate. If certain wetlands or riparian areas cannot be mitigated, or do not recover, their loss would be irreversible.

Residual Effects

Wetlands and riparian areas associated with springs/seeps and streams that are predicted to be affected are expected to eventually return to near pre-mining conditions and not experience any residual impacts. If streams or springs are dewatered, their associated vegetative community could be altered toward a more upland community. As streams and springs recover, the vegetative community would be altered toward a more wetland community. While there is uncertainty that springs/seeps and streams would be affected, it is possible that some springs/seeps, if eliminated by dewatering, might not recover. Proposed mitigation measures (which could be conducted concurrently with mining) are expected to minimize adverse impacts and maintain conditions conducive to the recovery of wetlands and riparian areas.

TERRESTRIAL WILDLIFE

The primary impacts on terrestrial wildlife were discussed in the original EIS (BLM, 1993). Those potential impacts included direct loss of habitat (primarily sagebrush/grassland) and the loss or displacement of wildlife from affected habitat. Some of this loss would be pronghorn winter range and/or mule deer transitional range. Potential loss or reduction of some springs, seeps, and small streams due

to groundwater drawdown would impact terrestrial wildlife dependent on these sites (e.g., amphibians, chukar, songbirds, waterbirds, small mammals, sage grouse, and predators) and may affect distribution of other species (e.g., bats, raptors, and mule deer) that use these sites as part of a larger habitat complex. Any loss or reduction in water provided for grazing cattle would **also affect wildlife**.

Direct and Indirect Impacts

Proposed Action

The Proposed Action would result in direct loss of 1,392 acres of terrestrial wildlife habitat, including a limited amount of riparian habitat, until such habitat is reclaimed. One hundred thirty nine of these acres would not be reclaimed as they represent the incremental expansion of the Gold Quarry pit. Habitat losses would result from expansion of many existing facilities. Terrestrial wildlife is currently acclimated to these existing facilities**.** New facilities would be constructed or expanded in sections 10 and 14, T33N R51E, and Section 18, T33N R52E. These are the primary areas where terrestrial wildlife might still be displaced. Wildlife use of the lands in R51E is primarily by mule deer as transitional range, and primary use of lands in R52E is by pronghorn as winter range.

The original EIS (BLM, 1993) fully discussed the potential impacts to terrestrial wildlife, and the expansion of facilities for SOAPA would continue those impacts in kind and magnitude. The following discussion represents a summary of potential incremental impacts expected from the expansion.

SOAPA would have direct effects on wildlife through accidental mortalities to wildlife that come in contact with lethal and sublethal solutions in the tailing facility**,** launders**,** transfer canals, leach pads, and process ponds. Historically, the South Operations Area Project has experienced approximately four bird mortalities per quarter and approximately one small mammal mortality per year. Newmont continues to seek means of reducing these mortalities, but a similar or lower frequency of mortalities is anticipated.

Upon cessation of dewatering of the Gold Quarry pit and recovery of the water table, a lake would form in the pit. This lake would be approximately 16 percent larger than the lake analyzed for the original EIS (BLM, 1993). The surface of the lake would be approximately 300 feet below the pre-mining surface of the pit. Birds, amphibians, reptiles, and large and small mammals **w**ould **likely** access the pit lake**. Since pit lake water quality is predicted to meet or be close to aquatic life standards, no effect on wildlife that access the pit lake would be expected.**

Some chukar upland habitat (steep-rocky slopes) would be lost, but this loss would be small compared with habitat available in the study area. The groundwater drawdown would potentially result in loss of free water and riparian habitat at several seeps near Simon Creek. Dewatering would also potentially impact available water in Lynn Creek and Simon Creek.

Since chukar, Hungarian partridge, and mourning dove are dependent on available water, the loss of water sources would limit the use of suitable habitat during the late spring to mid-fall period.

Expansion of the Gold Quarry South WRDF, Gold Quarry North WRDF, James Creek WRDF, and creek diversions would remove about 812 acres of historic mule deer

transitional range. The existing SOAPA facilities already act to bisect this historic range, and act as a barrier to deer moving through this traditional transition range (**Figure 3-11**). Deer that used the historic range to access their winter and summer ranges, now utilize habitats west and north of the mine (Wilkinson, 1998). Because the proposed actions would occur on and immediately adjacent to the southern portion of the existing mine it is not anticipated that deer would be adversely impacted.

No known sage grouse display sites (leks) would be impacted by the Proposed Action. Under the proposed action, approximately 1,253 acres of year-round habitat would be lost for the life of the project, pending successful reclamation, and 139 acres of the same habitat would be permanently lost from the open pit expansion. The groundwater drawdown could impact up to 2.5 acres of riparian habitat at five springs and seeps and a limited amount of riparian habitat along streams. Approximately six acres of riparian habitat occur within the 10-foot drawdown contour but outside the spring domains and outside the 1993 drawdown contour (**Figure 4-18)**. The remaining acreage occurs along other streams and the Humboldt River.

Raptors would also be affected by the loss of prey base as a result of disturbance of 1,392 acres of upland habitat. Because most raptors usually range over large areas, this loss is not quantifiable but is probably minor and would not result in a change in raptor diversity. Some raptors would be able to take advantage of prey availability in reclaimed habitats. In addition, most raptors in the area should be habituated to ongoing mining activities and new disturbances should not further impact these species.

Other groups of species such as small mammals and migratory birds may be affected by the proposed action. All facilities are fenced to prevent entry by large mammals, but small mammals and birds can gain access. Migratory birds could come in contact with tailing liquids along the beaches of the Tailing Disposal Facility. **The process is designed to maintain t**hese liquids **with** a WAD cyanide **concentration** of less than 25 mg/L. This level is not lethal to birds, but a sub-lethal effect is postulated by researchers on birds that are stressed, such as during migration. Birds can also be exposed to metals and trace elements in the pit lake. However, of the metals with aquatic life standards, only molybdenum is predicted to exceed the 1-hour average standard. The pit lake is predicted to have a pH level of 7.8, well above the level that could pose acidic-water toxicity risks (pH levels less than 4.0). Biomagnification of metals and trace elements by aquatic organisms to levels potentially lethal to migratory birds could possibly develop over the long-term. Migratory birds may also be exposed to a total loading of metals and trace elements in the Humboldt River that is higher than premining conditions, even though all discharges are in compliance with water quality standards. If streams or any flat water areas were decreased by dewatering drawdown, some migratory birds might experience displacement and expend additional energy searching for suitable resting or foraging habitat. This could potentially compromise the survival of some birds, especially those stressed by migration.

Water from the dewatering system and/or storage reservoir would be discharged into Maggie Creek and eventually the Humbolt River. Discharge flows would vary, but would eventually peak at less than 30,000 gpm. This

rate is more than 12,000 gpm **lower** than was **analyzed** in the original EIS (BLM, 1993). The original analysis indicated that some wildlife may have difficulty crossing Maggie Creek at higher flows. This has not proved to be the case. However, if flows are sufficient in the spring, antelope may have difficulty leaving their winter range to access transitional and summer ranges (Wilkinson, 1998). A similar situation would occur for mule deer attempting to move from crucial winter range east of Carlin to crucial winter range west of Carlin, although the magnitude of the impact would be less than for pronghorns. During high water periods in the spring, Newmont would store discharge water in the Maggie Creek Ranch Reservoir.

Alternatives

Backfilling of the Mac Pit

Impacts to the wildlife resource as a result of this alternative would be similar to those described for the Proposed Action. The only difference would be that the Mac pit would be backfilled with waste rock, thus providing an additional 40 acres of wildlife habitat. By placing the waste rock back into the Mac pit the size or height of both the Gold Quarry North and South WRDFs would be reduced by six acres. This alternative would result in additional wildlife habitat, both from smaller WRDFs and from the backfilled pit. All other potential impacts would be the same as described under the proposed action alternative.

Modified Waste Rock Disposal Facilities

This alternative is essentially the same as the Proposed Action, ex**cept** for the handling of the waste rock. Under this alternative some waste rock would be hauled to various areas for road and embankment construction. In addition, the Gold Quarry South WRDF would be constructed higher and therefore minimize its footprint. This would result in 50 acres less potential wildlife habitat being lost within the footprint. This alternative would also result in three fewer acres of disturbance for construction of a water diversion around the South WRDF.

No Action Alternative

The No Action Alternative would have no additional impacts on wildlife other than those already projected at the South Operations Area Project. Dewatering effects and habitat disturbance would cease in 2001, rather than 2011 under the Proposed Action.

Potential Mitigation and Monitoring

Numerous mitigation or monitoring activities are currently being implemented by Newmont as part of their approved Mitigation Plan (BLM, 1993). These measures include:

- Reclaim most disturbed areas to a diverse, self-sustaining ecosystem. This mitigation measure is ongoing in the case of concurrent reclamation. Newmont has reclaimed some areas which, preliminarily, appear to be diverse and self-sustaining. Final reclamation would not occur until mining operations cease.
- Implement the Maggie Creek Watershed Restoration Project to improve wildlife habitat within the upland, riparian and wetland areas adjacent to Maggie, Simon, Jack, Little Jack, and Coyote creeks. This measure was described previously under water resources and has proved effective.

- Realign and redesign the North Area Haul Road to facilitate mule deer migration. This mitigation measure has proven successful in regard to preventing mule deer mortality.

- Conduct restoration on the Dunphy Hills Winter Range (Gold Quarry Mitigation Plan) and Tuscarora Transition Range (South Operations Area Project Mitigation Plan). This rehabilitation was initiated (on over 6,500 acres) in 1992 and completed in 1998. **Management of the area and o**bservations on the effectiveness of the restoration are ongoing.

- According to Bob's Flat EFR and the Mule Deer Mitigation Reseeding Cooperative Agreement - Special Stipulation - Item O, and adjusted acres that were rehabilitated, Newmont could elect to apply acres that cannot be reclaimed (e.g. the 139-acre pit) to the acreage in the "mitigation bank." According to BLM calculations for mitigation, the following seedings were completed on public lands as mitigation for the effects of Newmont mining operations on mule deer habitat and, in effect, are in the "mitigation bank:" 1,538 acres on the aerial block, 949 acres on the Geenstrip block, and 940 acres on the mid-elevation block, for a total of 3,427 acres. Four other Newmont projects required mitigation for 1,386 acres that are to be subtracted from the 3,427 acres. The 2,041 remaining acres can be applied to mitigate effects of past, present and future mining actions as stated in the Cooperative Agreement.

- The 2,041 acres in the "mitigation bank" can be applied as mitigation for mule deer habitat permanently lost to the pit expansion of 139 acres. In addition to following the format established in the SOAP Mitigation Plan (BLM, 1993), Newmont should consider fencing or resting the seeded area from livestock use for a minimum of three growing seasons on either public land or lands owned by Newmont, or a combination thereof. The BLM would consider a third-party arrangement to complete NEPA documentation and rehabilitation work through consultation with BLM, Newmont, and possibly NDOW. An agreement on grazing management on the seeded area over the long-term should be an item negotiated in the final Mitigation Plan to be developed as part of the Record of Decision for this project.

- The 139 acres of sage grouse habitat permanently lost to the pit expansion could be mitigated in other ways such as off-site habitat enhancement, creation of new water sources (guzzlers), additional protection for known leks, or other measures to be identified in the Final Mitigation Plan for the Record of Decision.

- A potential mitigation measure would be the establishment of a monitoring site at the pit lake. The site should include water quality including metals and trace minerals, development of aquatic organism communities, and wildlife use of the lake.

- Compliance with the Migratory Bird Treaty Act would be ensured through the use of mitigation measures. Such measures would include conducting land clearing outside the breeding season of migratory birds utilizing the site; conduct

nest surveys prior to land clearing if inside the breeding season; and the use of buffer zones around identified nests during the breeding season.

Irreversible and Irretrievable Commitment of Resources

Wildlife resources are generally considered renewable. If wildlife habitats lost through implementation of the Proposed Action or alternatives are reclaimed to pre-mining condition after project completion, only open pit areas would be irreversibly and irretrievably lost to wildlife resources.

The degree of land surface recovery after mining ceases would depend on success of reclamation. It is highly unlikely that reclamation would create habitat similar in quality to pre-mining conditions. As a result of not having pre-mining quality habitat, it is probable that diversity and density of many species would not recover to pre-mining levels within the foreseeable future.

There is a possibility that small, isolated populations of some species of small mammals, reptiles, amphibians, or invertebrates associated with springs could be irretrievably lost if springs dry up. Repopulation through dispersal would likely be slow or nonexistent if affected springs are isolated from unaffected wildlife populations by areas of unsuitable habitat or relatively large distances.

Residual Effects

Even though the Gold Quarry pit would be bermed or fenced, some mammals may possibly enter the steep-walled pit and drown. The juvenile pit lake (after five years) is expected to have a pH of 7.4 and 876 mg/L of total dissolved solids. After 250 years, the lake is expected to have a pH of 7.8 and TDS of 783 mg/L (Geomega, 1997b). Pit lake water quality is not expected to be injurious to wildlife such as birds and bats **because water quality generally would be good, rarely exceeding drinking water or aquatic life standards, and any exceedances would be small.** It will also take some time for water quality in the pit lake to stabilize.

When lands disturbed by the expansion facilities are fully revegetated following reclamation, the habitat would be less diverse than prior to mining. This habitat would not support the same numbers or diversity of wildlife as existed prior to mining. Any unmitigated loss of springs/seeps or wetlands/riparian areas would reduce the diversity of small mammals, birds, and other organisms dependent on the wetted areas. If terrestrial wildlife are lost as a result of lost riparian areas that don not recover after dewatering ends, their loss would be a residual effect. If metals and trace elements are elevated or concentrated in the Humboldt River or in the pit lake with resultant deleterious effects on terrestrial, aquatic, or avian species, those effects would be residual over long time periods.

AQUATIC HABITAT AND FISHERIES

Potential impacts of the SOAPA on aquatic habitat and fish would be associated primarily with potential alteration of surface water baseflows and spring flow. These potential baseflow reductions would result from continuation of the dewatering program with resultant groundwater drawdown for a longer period than previously analyzed and over an incrementally larger area. Reduced surface

water baseflows may eliminate or severely reduce numbers of fish and many aquatic invertebrates. Extension of the ongoing dewatering discharges would extend the period of reduced baseflows following the cessation of mining and thus have the most potential to affect the Humboldt River.

Direct and Indirect Impacts

Proposed Action

Dewatering Impacts

Potential impacts of the SOAPA on aquatic habitat and fish could result from potential alteration of surface water baseflows. Refer to the Water Resources Section for a detailed discussion of these predicted drawdown impacts. Because, for the purposes of this resource, the SOAPA is primarily an extension of the dewatering period, the impacts would be of the same kind as those presented in the original EIS (BLM, 1993), but would be expanded in area and in time.

The currently approved dewatering operation would end in 2001. The proposed SOAPA would extend the dewatering until 2011. This extension would result in a deeper drawdown of the water table (cone of depression) than would occur under the currently approved project. Accordingly, this could reduce more surface water baseflows and over a farther distance from the Gold Quarry pit, and lengthen the groundwater recovery period.

The incremental expansion of the predicted 10-foot groundwater drawdown contour line is used as the definition of the area of potential surface water impact. Groundwater drawdown would occur outside of the 10-foot drawdown line; however, these changes would be difficult to distinguish from seasonal or long-term natural variations. In most of the modeled area, the depth to groundwater is greater than 50 feet so that groundwater drawdown does not interact with surface water and would not impact surface water (Newmont, 1999b).

Potential drawdown impacts (see Water Resources) could diminish the amount and condition of aquatic habitat. This would affect the aquatic invertebrates and fish species that depend on those water sources by reducing or eliminating species from a particular aquatic habitat. Up to five spring and seep sites could be affected through reduced or complete loss of flows in the incremental area of groundwater drawdown.

Streams with portions of their length within the incremental 10-foot drawdown contour within the Maggie Creek subbasin include **lower Fish, middle and lower Marys Creek (primarily the Carlin "Cold" Spring), lower Maggie Creek, and upper Lynn Creek.** Actually, the revised groundwater model serves to remove approximately 4.5 miles of Maggie Creek from within the predicted 10-foot drawdown contour. The removed area of Maggie Creek is immediately above Maggie Creek Canyon. Additionally, baseflow in the Humboldt River between Carlin and Palisade is predicted to decrease by as much as 4.9 cfs (2,200 gpm) after dewatering ceases and to have a long-term reduction of about 1.5 cfs (673 gpm) (HCI, 1999).

Maggie Creek watershed restoration work conducted to mitigate for dewatering impacts predicted in the 1993 EIS would also mitigate the impacts predicted to occur from the extension of dewatering to year 2011. Grazing practices which favor riparian vegetation establishment have an important influence in

reducing erosion resulting from discharge flows.

Discharge Impacts to Maggie Creek and Humboldt River

The SOAPA proposes to continue discharge of mine-water to lower Maggie Creek. The discharge is located approximately seven miles north of its confluence with the Humboldt River. This discharge potentially affects aquatic biota by increasing stream temperatures, increasing streamflows, and decreasing dissolved oxygen compared to natural conditions.

Increasing the stream flows to lower Maggie Creek would not accelerate bank erosion, increase sediment transport, nor increase lateral channel migration BLM, 1993. Newmont has constructed bank stabilization structures within the Maggie Creek channel which serve to mitigate these effects (Chapter 4, Water Resources). Other water quality impacts expected from discharge of excess mine water to Maggie Creek and the Humboldt River include potentially higher loadings of metals and trace elements, which could result in effects on species in the Humboldt River and the Humboldt Wildlife Management Area.

Alternatives

Both the action alternatives would have the same potential impacts to aquatic habitat and fisheries as those described for the Proposed Action, as the amount of dewatering would be the same.

No Action Alternative

The No Action alternative would result in those potential impacts on aquatic resources that have been analyzed in the original EIS (BLM, 1993). Under the No Action alternative, current mining operations, including dewatering activities, would continue until 2001. The same streams would have potential dewatering effects except upper Lynn and Fish creeks. Potential dewatering of Maggie Creek may be some what greater than under the Proposed Action because modeling in 1993 predicted more of Maggie Creek was in the drawdown contour.

Potential Mitigation and Monitoring

Impacts that were predicted to occur as a result of the existing Project were mitigated by Newmont implementation of the Mitigation Plan (BLM, 1993). Many items have been completed or are currently being implemented. A summary of items in the plan is as follows:

- The Maggie Creek Watershed Restoration Project is a program to achieve restoration and enhancement of upland, riparian and wetland habitat in the Maggie Creek subbasin through a cooperative effort among Newmont, the BLM, the TS Ranch, the Maggie Creek Ranch, and others. This will continue to enhance aquatic habitat in the subbasin. Results of this project were summarized in the mitigation section of Riparian, Wetland and Waters of the U.S. section earlier in this chapter.

- Mitigation of potential baseflow losses to creeks, including Maggie, Susie, James, Soap, and other area creeks through riparian improvement projects and, if necessary to protect riparian and aquatic values, through temporary stream baseflow augmentation in middle Maggie Creek, Susie Creek, and biologically important seeps and springs.

- Recolonization of depleted sections of the Humboldt river using indigenous invertebrates after monitoring determines the need. This mitigation measure has not yet been necessary.

- Prevention of increased sediment loading to the Humboldt River through implementation of channel stabilization measures and creation of a polishing wetland at the base of Maggie Creek. This has been accomplished and demonstrated to be effective.

- Prevention of temperature increases by construction of cooling towers. The towers have been constructed and demonstrated to be effective.

Recent field reconnaissance surveys and BLM monitoring reveal that these mitigation procedures are effective in providing mitigation for the existing project. Riparian and aquatic habitat in Maggie Creek and several tributaries have improved dramatically since initiation of the restoration efforts. Recommendations for mitigation of the proposed amendment would be to continue with the current mitigation strategies. Additional mitigation recommended is presented in the Threatened and Endangered Species Section below.

Irreversible and Irretrievable Commitment of Resources

There is potential for irreversible or irretrievable commitment of aquatic resources resulting from the dewatering of springs/seeps or stream reaches. If springs or streams are dewatered, the aquatic habitat may no longer be able to sustain the existing populations of aquatic species. If recovery of the springs or streams does not occur or is not adequate to restore the habitat, there would be irretrievable loss of aquatic wildlife. Mitigation measures have been identified for these potential effects, and if successful, would mitigate irreversible or irretrievable commitments of aquatic resources. Given the uncertainty of the potential loss of the surface expression of springs or seeps due to groundwater drawdown, it is also uncertain whether mitigation would be successful. If not, spring/seep loss would be irretrievable.

Residual Effects

Aquatic habitats associated with smaller tributaries to Maggie Creek could experience losses during the period of dewatering, but are expected to return to near premining conditions over a long time. The degree to which they fail to return to premining conditions would be a residual effect.

THREATENED, ENDANGERED, CANDIDATE AND SENSITIVE SPECIES

Direct and Indirect Impacts

Proposed Action

Bald Eagle

Bald eagles wintering along the Humboldt River would experience minor impacts due to the greater expanses of ice-free water in winter. Discharge of water at temperatures within 2°C of Humboldt River water would slightly increase the amount of ice-free water and attract migrating and wintering waterfowl, a potential food source for eagles. Eagles might be exposed to increased concentrations

of metals and trace elements if fish tend to biomagnify those elements. After discharge from Gold Quarry dewatering ceases, some reaches of the Humboldt River below Carlin may have reduced baseflows due to the cone of depression. Periodic cessation of flow probably would reduce fish populations. This impact would be minor because eagles within the project area primarily rely on jackrabbits and carrion for winter food.

Lahontan Cutthroat Trout

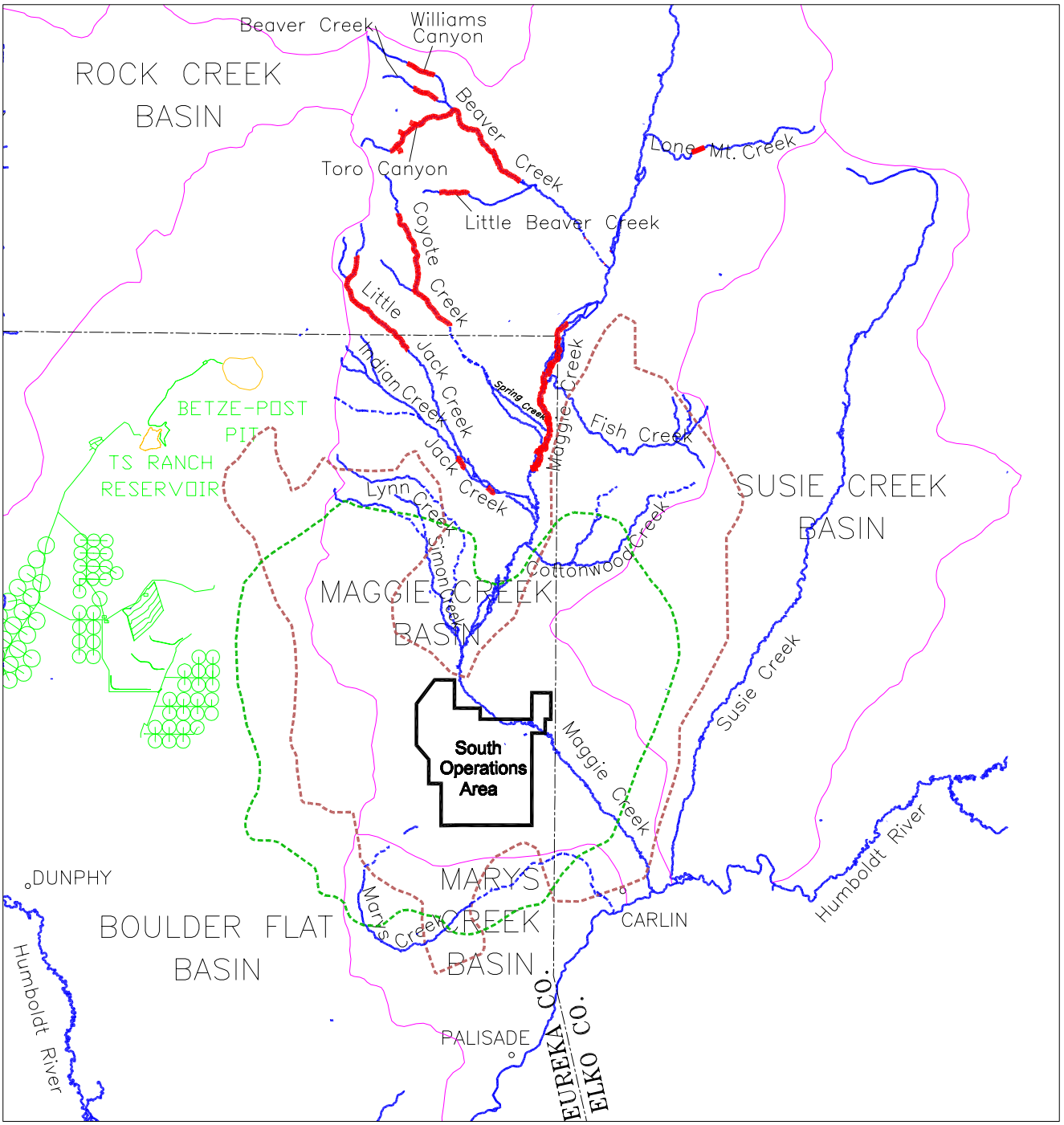
No habitat containing Lahontan cutthroat trout would be directly affected by the incremental expansion of the 10-foot drawdown contour (**Figure 4-19**). Potential indirect effects on the trout remain as they were analyzed in the original EIS (BLM, 1993). The SOAPA would serve to extend the same kinds of effects to approximately 2011. Actually, the groundwater modeling for the SOAPA essentially removed approximately 4.5 miles of middle Maggie Creek from within the 10-foot drawdown contour, thereby reducing the potential somewhat, for effects on that reach of stream. Additionally, Maggie Creek is fed by 34 feeder streams, only one of which is predicted to be affected by dewatering in their headwaters, so the potential for dewatering effects on the mainstem of Maggie Creek may be masked by flow contributions from the feeder streams not potentially affected by drawdown. Potential effects on Maggie Creek are expected to remain as described in the original EIS (BLM, 1993). Potential LCT re-introduction habitat in Susie Creek is also predicted to have reduced baseflows (BLM, 1993).

Lahontan cutthroat trout have been absent from lower Maggie Creek for decades as a result of degraded habitat conditions from livestock grazing, pre-project low baseflows, and the fact that lower Maggie Creek is a naturally losing stream and periodically went dry. Therefore, discharge of excess water into lower Maggie Creek and subsequent dewatering of the stream channel during groundwater recovery would not affect existing Lahontan cutthroat trout habitat.

Although Susie Creek is not currently inhabited by Lahontan cutthroat trout, the Lahontan cutthroat trout Recovery Plan has identified it as a potential Lahontan cutthroat trout reintroduction stream (USFWS, 1995). Susie Creek baseflow near its confluence with the Humboldt River, is predicted to decrease from 0.8 to 0.6 cfs due to implementation of the SOAPA and cumulative mining actions in the region (Chapter 4, Water Resources Section). These effects on Susie Creek are expected to occur in the lower reach near its confluence with the Humboldt River.

Columbia Spotted Frog

Mine dewatering is not expected to affect any of the perennial surface water reaches in the Maggie Creek subbasin where spotted frog populations have been found (Maggie Creek upstream of the Coyote Creek confluence, Little Jack Creek, Spring Creek, and Coyote Creek). All these locations are more than one-half mile outside the 10-foot drawdown contour, and spring sources contributing to these streams are also outside the drawdown contour.



LEGEND

- Current Distribution of Lahontan Cuthroat Trout
- 1999 Predicted 10ft Drawdown Contour
- 1993 Predicted 10ft Drawdown Contour
- Basin Boundaries
- Conveyance/Irrigation
- Streams
- Intermittent Streams

N

0 5 10

Scale in Miles

Source: BLM, 2000b

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-19 CURRENT DISTRIBUTION OF LAHONTAN CUTTHROAT TROUT IN MAGGIE CREEK BASIN

MINE AREA: SOUTH AREA	
DATE: 8/16/00	ACAD FILE: Fig3-11.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

Other Species of Concern

Potential direct impacts from dewatering to certain BLM sensitive species, could result from habitat destruction and degradation, displacement from habitat, and reduction of wetlands and riparian zones. The original EIS (BLM, 1993) fully discussed the potential impacts to wildlife species of concern, and the expansion of facilities for SOAPA would continue those impacts in kind and magnitude. The following discussion represents a summary of potential incremental impacts expected from the expansion.

Potential impacts to ferruginous hawks, burrowing owl, and northern goshawks would be less than the minor effects identified in 1993. The potential long-term loss of some seeps, springs, and stream reaches within the incremental area of potential impact to surface waters could reduce the amount of potentially available habitat for Preble's shrew. Various bats including Townsend's big-eared, long-legged myotis, long-eared myotis, fringed myotis, small-footed myotis, and spotted bat would be anticipated to experience less than the minor effects identified in 1993.

However, if metals and trace elements are elevated in the pit lake, bats (and raptors) would be exposed to those increased levels.

Potential effects on white-faced ibis, least bittern, and black tern would experience effects less than those considered low in 1993. However, these birds could possibly be exposed to elevated levels of metals and trace elements as they forage along the Humboldt River. This exposure, while unlikely to be lethal, may have sublethal effects over time that might affect overall health of the birds. Effects on the Nevada viceroy butterfly were related to potential habitat loss and the losses would be less than were identified in 1993. The Proposed Action would extend the potential effects in time.

Springsnails are considered important because of their restricted distribution and native origin. Springsnails are present in 10 springs in the region. None of these springs are within the 10-foot drawdown contour, therefore there should be no effects to spring snail populations.

No sage grouse leks would be impacted directly by the proposed incremental expansion. The pit expansion of 139 acres represents a permanent loss of sage grouse habitat because the pit would not be reclaimed following mining. The groundwater drawdown would potentially affect areas of wetland habitat at several springs and seeps. The loss of these vegetation types would serve to eliminate brood-rearing habitat at these sites, potentially altering the sage grouse distribution during summer and autumn, and potentially reducing the total sage grouse population.

Improvements to riparian habitat conditions within the (BLM, 1993) predicted zone of impact should mitigate potential impacts to the California floater. In addition, if the annual recalibrated model extends the drawdown contour to that portion of Maggie Creek where two California floaters were found, or if the groundwater level in well MAG-A (described in the Water Resources Section) falls to less than one foot above the elevation of the bed of Maggie Creek, then a study could be conducted by a third party agreeable to Newmont and the BLM to determine if a viable population of California floaters exists in this reach of the creek. If the groundwater

level in well MAG-B falls to less than one foot above the elevation of the bed of Maggie Creek at that location, Newmont would initiate, within fourteen days, consultation with the BLM concerning possible augmentation of Maggie Creek below the confluence of Coyote Creek and Maggie Creek.

Alternatives

Under the action alternatives, the 10-foot drawdown contour would expand and incrementally affect five seeps and springs. This combined with the additional 10 years of drawdown could adversely impact potential aquatic habitat for certain species of concern. Some species or individuals of bats displaced by potentially reduced surface water resources would be able to utilize the pit lake as foraging habitat.

Backfilling of the Mac Pit

Impacts to the threatened, endangered and BLM sensitive species as a result of this alternative would be similar to those described for the Proposed Action. The only difference would be that the Mac pit would be backfilled with waste rock. By placing the waste rock back into the Mac pit, 40 acres of wildlife habitat would be made available and the size of both the North and South WRDFs would be reduced by approximately six acres. This would result in less potential habitat for the ferruginous hawk being lost under the WRDFs.

Modified Waste Rock Disposal Facilities

This alternative is essentially the same as the Proposed Action, except for the handling of the waste rock. Under this alternative some waste rock would be hauled to various areas for road and embankment construction. In addition, the South WRDF would be constructed higher rather than larger in area. This would result in 50 acres less potential wildlife habitat being lost within the footprint. This alternative would also result in three fewer acres of disturbance for a water diversion being constructed around the South WRDF.

No Action Alternative

The No Action alternative would result in the same potential impacts on threatened, endangered, candidate and special status species that have been stated in the original EIS (BLM, 1993). Under the No Action alternative, mining operations, including dewatering activities, would cease in 2001.

Potential Mitigation and Monitoring

Impacts that were predicted to occur as a result of the existing South Operations Area Project were mitigated by Newmont by implementation of the associated Mitigation Plan (BLM, 1993). Many items have been completed or are currently being implemented. A summary of items in the plan was presented in the Aquatic Habitat and Fisheries section earlier in this chapter.

Recent field reconnaissance surveys and BLM monitoring reveal that these mitigation procedures are effective in providing mitigation for the existing project (BLM, 1997a). Riparian and aquatic habitat in Maggie Creek, Little Jack Creek, Coyote Creek and other tributaries have improved dramatically since initiation of the restoration

efforts. Recommendations for mitigation of the proposed amendment would be to continue with the current mitigation strategies.

Starting in 1993, Newmont and the TS Ranch have conducted a reseeding and improvement program in the Dunphy Hills area, much of which was burned and became dominated by cheatgrass, a poor vegetation for muledeer and sage grouse. Over 3,800 acres of public land have been seeded to grasses and other species, then over-seeded with sagebrush and rabbitbrush. These seedings are contributing to muledeer and sagegrouse habitat.

Additional mitigation recommended would be as follows:

- Potential mitigation could include replacement of the perched culverts with structures designed for fish passage at the road crossings of the Maggie Creek tributaries that have Lahontan cutthroat trout habitat. This might or might not increase the meta population potential of the Maggie Creek subbasin. The subbasin currently has low meta-population potential due, in part, to the culverts creating barriers to migration, and because lower reaches of several tributaries dry up after spring runoff.

- Newmont's commitment to provide baseflow augmentation in 1993 (BLM, 1993) would continue in force, if and when the need arises. More information is now available concerning rewatering for the restoration of fisheries and riparian values in dewatered streams. An example is Hill and Platts, 1998. "Ecosystem Restoration, A Case Study in the Owens River Gorge, California."

- Potential mitigation could include creation of a permanent migration barrier in lower Maggie Creek to eliminate the possibility of nonnative trout (primarily rainbow) from migrating from the Humboldt River into Lahontan cutthroat trout habitat in upper Maggie Creek.

- Simon and Jack Creeks have potential to be recovered for Lahontan cutthroat trout habitat. An intensive recovery program similar to that occurring in adjacent Maggie Creek tributaries could be conducted for dewatering mitigation.

- Newmont will continue to mitigate the potential effects of raptors and corvids (ravens and crows) on sage grouse, and other species of concern, as agreed to in 1993 (BLM, 1993) by ensuring effective and permanent (metal) anti-perching devices will be used to deter the use of powerlines and powerline structures as perches or nesting sites by raptors and corvids. Newmont agrees that any devices used would be maintained or upgraded, in coordination with the power company for the life of the powerlines associated with the SOAPA expansion within the Newmont study area, through Newmont in coordination with the power company.
- It is recommended that Newmont survey the powerlines between the North and South Operations Areas to ensure the lines are raptor-proof. A sage grouse lek is present in the area and raptors have been observed using the powerline. Ensuring anti-perch structures are present would mitigate effects on sage grouse.

- 139 acres of sage grouse habitat must be rehabilitated as mitigation. The 139 acres of sage grouse habitat permanently lost to

the pit expansion could be mitigated in other ways such as off-site habitat enhancement, creation of new water sources (guzzlers), additional protection for known leks, or other measures to be identified in the Final Mitigation Plan for the Record of Decision.

- Enhancement opportunities in Spring Creek should be evaluated. The stream looks promising but lacks salmonids (except for a marginal population of brook trout). Further evaluation of sediment loads, water quality, and habitat conditions is needed to determine restoration needs, as well as to monitor brook trout establishment, which would be catastrophic for Lahontan cutthroat trout. The Nevada Division of Wildlife plans on reintroducing Lahontan cutthroat trout to the stream as part of the **Nevada Species Management Plan** for that species.

Successful implementation of mitigation measures would eliminate residual adverse effects on other threatened, endangered, or BLM sensitive species.

In 1993, Newmont agreed to augment flows into ponds used by the Townsend's big-eared bat if the ponds were impacted. The ponds on Lynn's Creek washed out in spring 1993 and no longer exist (comment letter from D.J. Vandenberg, 2-3-99), and this mitigation measure became moot.

Also in 1993, Newmont agreed to reclaim disturbed areas and enhance the final pit wall with constructed overhangs and alcoves for raptors. This mitigation measure is ongoing in the case of concurrent reclamation, but final pit wall enhancement would not be conducted until after mining ceases.

Irreversible and Irretrievable Commitment of Resources

There would be no irreversible or irretrievable commitment of resources that would affect threatened, endangered, or BLM sensitive species if the approved mitigation measures outlined in the original Mitigation Plan (BLM, 1993), are implemented.

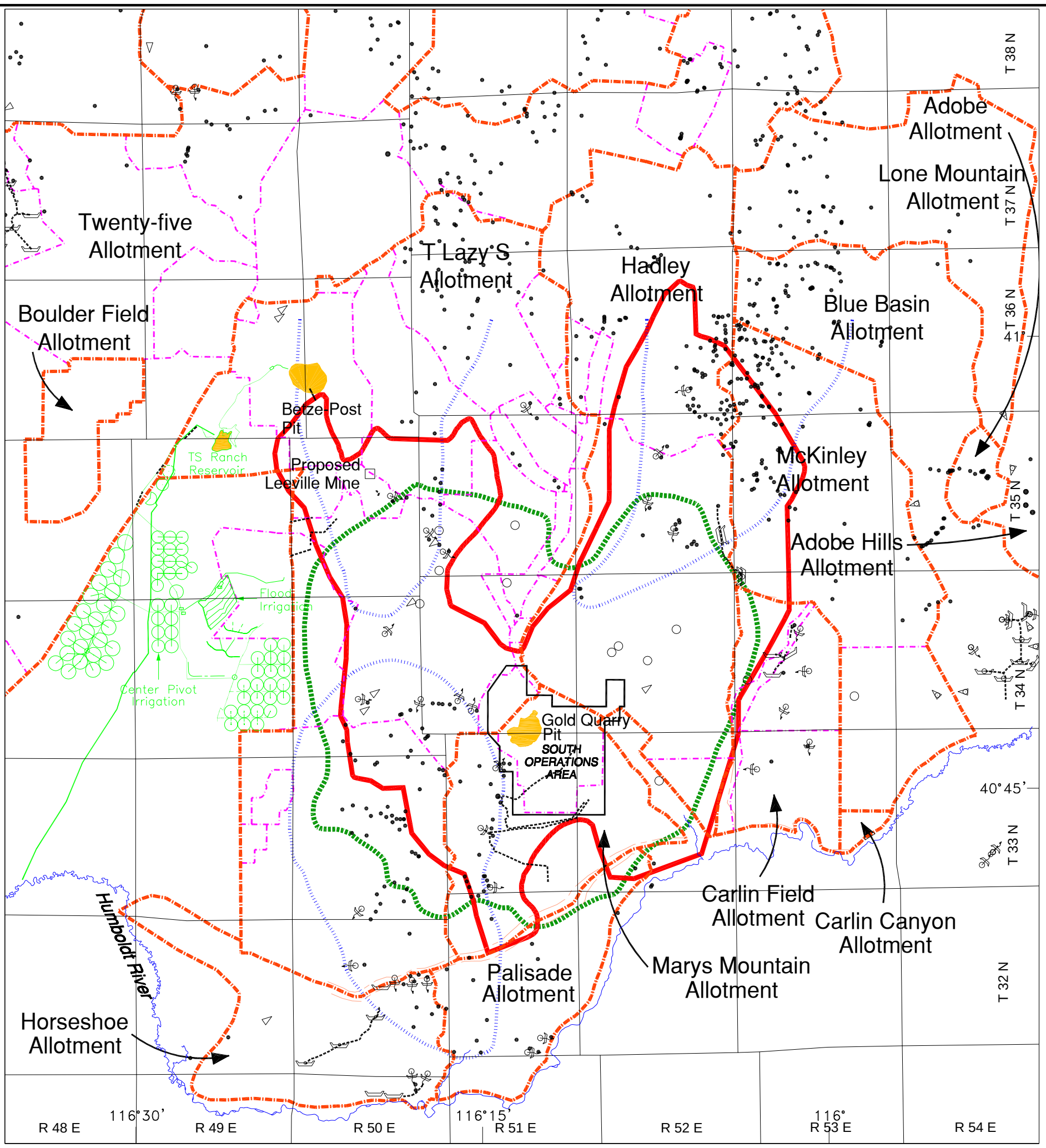
Residual Effects

Successful implementation of mitigation measures would eliminate any residual effects on threatened, endangered, candidate or special status species. This conclusion is based on implementing all mitigating measures from the existing Mitigation Plan (BLM, 1993) plus additional mitigation measures identified in this EIS and in the Cumulative Impact Assessment (BLM, 2000b).

LIVESTOCK GRAZING

The Proposed Action would result in 71 AUMs on public lands in Section 18 being suspended. Following mining and reclamation, these AUMs would be available for grazing use. In addition, in the area of incremental groundwater drawdown and recovery, a total of 5 springs and seeps, 11 wells and groundwater rights (three of which are stock wells) , and 2 streams (Marys and Maggie Creek) within the study area could be affected through reduction or loss of baseflow (**Figure 4-20**).

Livestock grazing in the study area would be affected by potential changes in stockwater availability associated with groundwater drawdown. If stockwater availability is



LEGEND

- 1999 Predicted 10ft Drawdown Contour
- 1993 Predicted 10ft Drawdown Contour
- Spring Domains
- Allotment Boundary
- Pasture Boundary
- Existing Water Pipeline
- Water Trough
- Stock Pond
- Spring
- Improved Spring
- Stock Well
- Center Pivot Irrigation

N

0 6 12

Scale in Miles

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-20
PREDICTED EFFECTS ON GRAZING ALLOTMENTS

MINE AREA: SOUTH AREA	
DATE: 8/3/00	ACAD FILE: Fig4-20.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

reduced, it may result in permanent reductions in stocking rates or periods of use on some grazing allotments. Some areas would be permanently lost to livestock grazing because they are not reclaimable, e.g., the expanded mine pit would result in 139 acres lost to grazing. Some steep slopes remaining after reclamation would experience limited grazing, e.g., approximately 330 acres would be steep slopes.

Direct and Indirect Impacts

Proposed Action

The Proposed Action would have direct, indirect and cumulative impacts on the grazing resources within the project area. These impacts would arise from three sources, permanent loss of grazing lands (e.g., open pit), temporary loss of grazing lands, and the reduction of water sources.

The proposed Action would directly result in the temporary suspension of 71 AUMs on public lands in Section 18 in the Mary's Mountain allotment. This total loss would be in addition to those losses accounted for in the original EIS (BLM, 1993). Impacts to grazing would result from two phenomena; the direct impact of loss of forage (temporary and permanent) from fencing out Section 18, and indirect impacts from possible loss of area to graze due to loss of water resources. The resulting impacts include possible reductions in stocking rates, possible herd reductions, and possible reduced income for the ranchers. The loss of water sources may or may not require reductions in stocking levels based on the amount of water lost (all or only some), the period of its loss (entire grazing season or just late summer), availability of other water sources (developed or undeveloped), and the amount of mitigation of lost water sources (Newmont has committed to replenish or replace spring flows lost as a result of dewatering). The loss of forage areas would be restored (less the area of the pit) following mine closure and reclamation.

It is anticipated that the reduction in AUMs (because of steep slope areas) would be a long-term impact. Upon closure of operations, the areas fenced off from grazing would be reestablished as grazing lands. Original grazing improvements would be replaced, and the area would be revegetated with the appropriate cover. As a consequence of these activities, it is expected that the suspension of AUMs in Section 18 would be restored after the closure of the mine.

Continued dewatering of the Gold Quarry pit would affect both surface water and groundwater resources, and therefore stockwater sources. Potential impacts to livestock grazing from dewatering would include changes in livestock distribution and forage utilization. There are three known stock wells (of the 11 total wells) within the incremental 10-foot drawdown contour (**Figure 4-5** and **Table 4-1**). Impacts on these wells would depend on their depth and location within the groundwater cone of depression. Based on the assessment presented in the Water Resources section of this chapter, only the Meierhoff irrigation well (Section 26, T33N R52E) with a known total depth could possibly be entirely dewatered.

Dewatering of the Gold Quarry pit could result in reduced baseflow or complete cessation of flow in five springs and seeps within the incremental predicted groundwater drawdown area (**Table 4-2**). Other springs have not been developed for livestock use, and

they may also provide water for livestock. Loss of these springs would displace livestock from forage that would then be too far from water to be usable.

Two developed springs that could be impacted by incremental dewatering are in the Hadley allotment. Two developed springs are in the Marys Mountain allotment, and one is in the McKinley allotment (**Figure 3-12**). If other springs in these allotments keep flowing at some level, they may supply enough water to compensate for springs that could dry up.

The central portion of the Hadley allotment could have reduced water availability if the two springs discussed above are dewatered, and wells of unknown depth are dewatered. Reduced water availability may also change areas into "secondary areas" virtually unuseable because of the distance from water.

Similarly, if the two springs in the eastern portion of Marys Mountain allotment are dewatered, availability of water in the central portion of the Marys Mountain allotment could be impacted. The same situation would occur in the west-central area of the McKinley allotment.

Range improvements potentially impacted by the Proposed Action include spring and well developments mentioned previously and a boundary fence between Marys Mountain and T Lazy S allotments in Section 34 (T34N R51W), on the west side of the SOAPA site. The boundary fence is currently within the mine boundary, but will be rebuilt after mine closure.

Alternatives

The alternative to backfill the Mac pit would create approximately 40 acres of area suitable for grazing after reclamation and revegetation was complete. The 40 acres would be in the T Lazy S allotment and could provide additional AUMs compared to the Proposed Action.

The alternative to modify the James Creek and South WRDFs would allow approximately 53 acres to remain disturbed by the WRDFs in comparison with the Proposed Action. The 53 acres are located in the Marys Mountain allotment and could represent AUMs not lost to the project.

No Action Alternative

The No Action alternative would have no additional impacts on grazing beyond those already permitted. The original EIS (BLM, 1993) predicted a reduction of 8,092 AUMs.

Potential Mitigation and Monitoring

Selected springs, seeps and streams would be monitored according to the approved Mitigation Plan. If any reduced flows are observed, the sources would be augmented or compensated by providing additional water in the same vicinity, as described in the

Mitigation Plan. Forage lost could be mitigated by rangeland seedings in areas outside the cone of depression (BLM, 1993). Newmont has seeded over 6,500 acres offsite for range and wildlife habitat. Additionally, Newmont has conducted several fencing projects around springs to prohibit cattle and preserve spring functions.

Other measures could include additional fencing placed at spring sites to prevent trampling, alternative water sources could beprovided through hauling or development of other wells or springs, changing the period of use to make maximum use of available water,

or other mitigation measures could be identified for negotiation in the Final Mitigation Plan that will be developed for the Record of Decision.

Irreversible and Irretrievable Commitment of Resources

There would be an irretrievable commitment of forage lost during and following mining, and an irreversible loss of forage due to the pit expansion. If the Proposed Action is implemented, 71 AUMs would be irretrievably lost from the use of Section 18 for the life of the project. There would also be an irretrievable loss of livestock grazing potential for the amendment area until revegetation is sufficient to allow grazing to resume.

Backfilling the Mac pit would allow reclamation of 40 acres that would have been irretrievably lost. The desired land use for the 40 acres would be wildlife habitat and grazing.

Residual Effects

There would be a reduction in livestock numbers due to the permanent unreclaimed features (Gold Quarry pit expansion) and steep slopes (WRDFs and leach facilities). Eventual recovery of groundwater levels in the project area is expected to restore baseflow to springs and seeps to near pre-mining levels (or with augmentation water) that were affected by dewatering. However, the total recovery period could be nearly 100 years, and if baseflows do not recover completely, that would constitute a residual effect.

RECREATION

The SOAPA would result in 1,392 fewer acres being available for recreational use after mining. No temporary workers associated with construction of new facilities are projected so there should be no impact to existing campgrounds and other recreationists in the area.

Direct and Indirect Impacts

Proposed Action

The potential effects of the construction and operation of the proposed facilities on recreation resources are based on how much opportunity is being lost for other recreation pursuits. The construction and operation of the proposed facilities can also affect recreation activities by altering the physical setting and visual quality of the recreation experience, by changing access opportunities, and by directly disrupting existing recreation activities. Direct impacts to recreation occur when available recreation lands are converted to restricted uses by proposed mine facilities.

The Proposed Action would not result in any increase in the level of visitation to existing recreational facilities identified in the original EIS (BLM, 1993). The only effect on recreation from the Proposed Action would be to extend existing levels of visitation on recreational facilities through the year 2011.

Land disturbed under any action alternative essentially would not be removed from existing recreation uses, as these lands are presently fenced to prevent public entry. The impacts to recreation opportunities, including the number of acres disturbed by the proposed amendment, in the project area and the Elko Resource Management Plan Area are common

to all action alternatives. None of the alternatives would reduce recreation opportunities in the project area and the Elko area.

The mining activities under any action alternative would not require any additional workforce. It is anticipated that the current workforce would be sufficient for the mine expansion. There would be no change in the level of visitor use of recreation areas and facilities in Elko and Eureka counties resulting from the addition of employees to the project workforce.

There are no developed recreation areas within or near the project area. There would be no change in existing levels of dispersed recreation activities on public lands surrounding the project area as a result of the mine expansion under any action alternative. It is anticipated that the existing level of recreation activity would continue on these lands. In general, any acreage removed from existing land uses by project facilities would be insignificant relative to the area available for these uses in adjacent areas of public lands. Once mining operations have ceased and public access is reopened, dispersed recreational opportunities would become available in most of the area that was closed for public safety.

Alternatives

Neither of the action alternatives would have any different impacts on recreation opportunities than would the Proposed Action.

No Action Alternative

No additional impacts to existing developed and dispersed recreation resources would occur under this alternative. The existing condition of BLM lands in the SOAPA area would be maintained under the current management direction as defined in the BLM's Elko Resource Management Plan and Final Environmental Impact Statement (BLM, 1987).

Potential Mitigation and Monitoring

Mitigation measures for recreation consist of continued implementation of the proposed conservation easement along Maggie Creek that Newmont granted to BLM, as described in Chapter 3. **The Maggie Creek conservation easement grants conditional uses to the public on private lands. The conservation easement will terminate when the terms of this agreement have been met. At the termination of the agreement, all uses of the land will revert back to the private land owner. The Maggie Creek Conservation Easement has been recorded with the Eureka County Recorder's Office book 338, pages 476-495.**

Irreversible and Irretrievable Commitment of Resources

Recreation would be irreversibly affected by the removal of surface lands by the Proposed Action.

Residual Effects

Recreation opportunities would be somewhat diminished in the long-term by the removal of surface lands by development of the Gold Quarry pit.

VISUAL RESOURCES

Visual impacts of the Proposed Action and alternatives were analyzed using procedures set forth in the Visual Contrast Rating Handbook (BLM, 1986). Changes in the landscape from the Proposed Action and alternatives are compared with the characteristic landscape to determine the resulting degree of contrast in form, line, color, and texture. To assess the change in landscape, the dimensions of the proposed facilities (length by width by height) were estimated in **Table 2-5.** The facilities could then be visually assessed against the existing landscape. Typically, facilities ranged up to a height of 400 feet and some had lengths greater than a mile. If the degree of contrast does not meet the Visual Resource Management objectives, the project should be redesigned or mitigation measures proposed. As noted in Chapter 3, most of the project site is located on Class IV land.

A small portion of the Maggie Creek and James Creek WRDFs would be located in a Class III VRM area. Objectives for Class III areas are to partially retain the existing character of the existing landscape. Because the acreage of disturbance is small relative to the total acreage of the Class III lands, and the final landforms of the WRDFs would be shaped during reclamation to blend with adjacent landforms, the Class III objectives would be met.

Contrast rating worksheets were completed from three key observation points (KOPs); these worksheets are included in **Appendix B**. The KOPs were selected to represent typical views of project features from within the affected area.

Visual simulations of appearance of the Proposed Action at the height of mining and after reclamation, were prepared to aid in this process. The three KOPs are described in Chapter 3 and shown in **Figures 4-21 through 4-23.**

Direct and Indirect Impacts

Proposed Action

The primary impact of the Proposed Action would be large-scale modification of landforms. Angular, blocky forms and horizontal lines would create moderate contrasts with the natural rounded, rolling hills and ridges of the characteristic landscape. The expansion of existing facilities would not create as strong contrasts as the creation of new land forms in an undisturbed setting.

Construction of leach pads and waste rock disposal facilities would expose soil and rock material in a variety of colors ranging from light grayish tan to reddish tan to very dark gray. Existing facilities indicate that most would be middle shades of tans and browns. Contrasts between these colors and those existing in the landscape would range from moderate in bright sunlight and when front-lighted to weak in overcast conditions and when back-lighted. Color contrasts would be reduced following successful reclamation and revegetation.

Visual impacts from new structures would be small when compared with the visually dominant waste rock disposal areas. The Gold Quarry pit would not be reclaimed but only the top of the high wall would be visible from any of the KOPs.

Visual contrasts between the natural landscape and the existing steam plumes from the roaster plant and the cooling tower would continue until the year 2011.

New structural features associated with the SOAPA Project would be limited to expansions of leach pads and waste rock dumps. Because of their proximity to existing structures, the new features would not appear as large structures in comparison with the visually dominating existing structures. Consequently, visual contrasts introduced by expanded structures would be weak.

When viewed from KOP 1, the Proposed Action would contrast weakly with the existing landscape as mine facilities are in the foreground- middleground, more than four miles away (**Figure 4-21**). The new structures in Section 18 would be closest to viewers while all other facilities would be largely screened by existing facilities. The new facilities would be substantial landform modifications, however, they would be visually coherent with existing modifications that currently exist in the view from KOP 1. The project would increase the physical extent of visual effects but would not introduce stronger degrees of contrast than currently exist nor would it introduce new types of landforms, lines, colors, or textures. In addition, existing visual impacts in the foreground reduce the visual dominance of mining activities from this KOP. Views of the mine by motorists on Interstate 80 (a distance of about 1.3 miles) would be decreased from approximately 75 to 65 seconds as a result of the higher speed limit now in place.

The project as viewed from KOP 1 would be consistent with the objectives for Class IV areas, which permit visual modifications to dominate the view.

Construction of the Property Leach Pad 2 and expansion of the Non-Property Leach Pad would be readily apparent from KOP 4 (**Figure 4-22**). This would be overshadowed by the much higher and more visually dominant mountain backdrop. As at other KOPs where existing mining operations are visible, no new landscape elements would be introduced; visual contrasts in form would remain moderate, while contrasts in line, color, and texture would remain weak.

Views of the proposed action from KOP 4 would be similar to those from KOP 1 except the proposed facilities would be in the middle-ground at a distance of approximately two miles. Views for a traveler on Highway 766 would be interrupted by a ridge immediately west of the highway. The steam plumes from the existing roaster and cooling tower would continue to be visible, especially during cool, wet weather. The plumes would be visible from all three KOPs. Color contrasts from the light colored earth materials would be noticeable as the new facilities would be closest to the viewer. No new form or line contrasts would be created. The pit high wall is visible from KOP 4 with the benches presenting weak line and color contrasts.

The project as viewed from KOP 4 would be consistent with the objectives for Class IV areas, which permit visual modifications to dominate the view.

Views of the proposed action from KOP 6 would be dominated by the existing facilities because the KOP is only approximately one mile northeast of the facilities (**Figure 4-23**).

Figure 4-21a
Existing conditions from KOP1, SOAPA Project

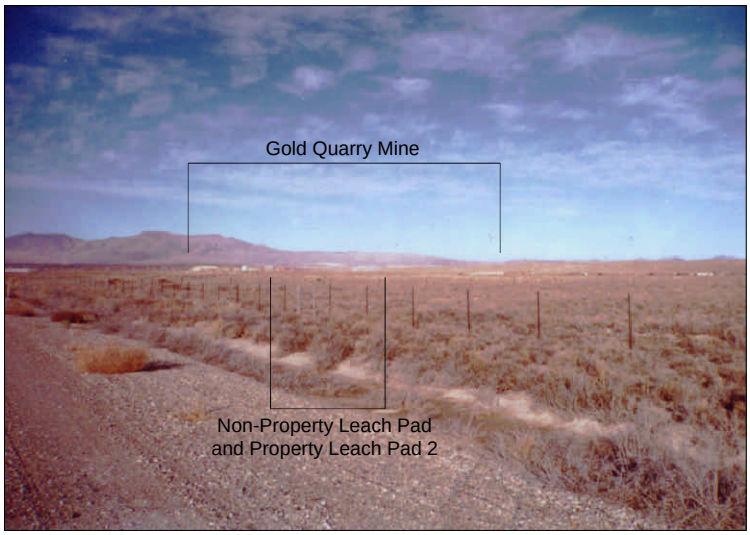


Figure 4-21b
Peak mining conditions from KOP1, SOAPA Project

Figure 4- 21c
Post-reclamation conditions from KOP1, SOAPA Project

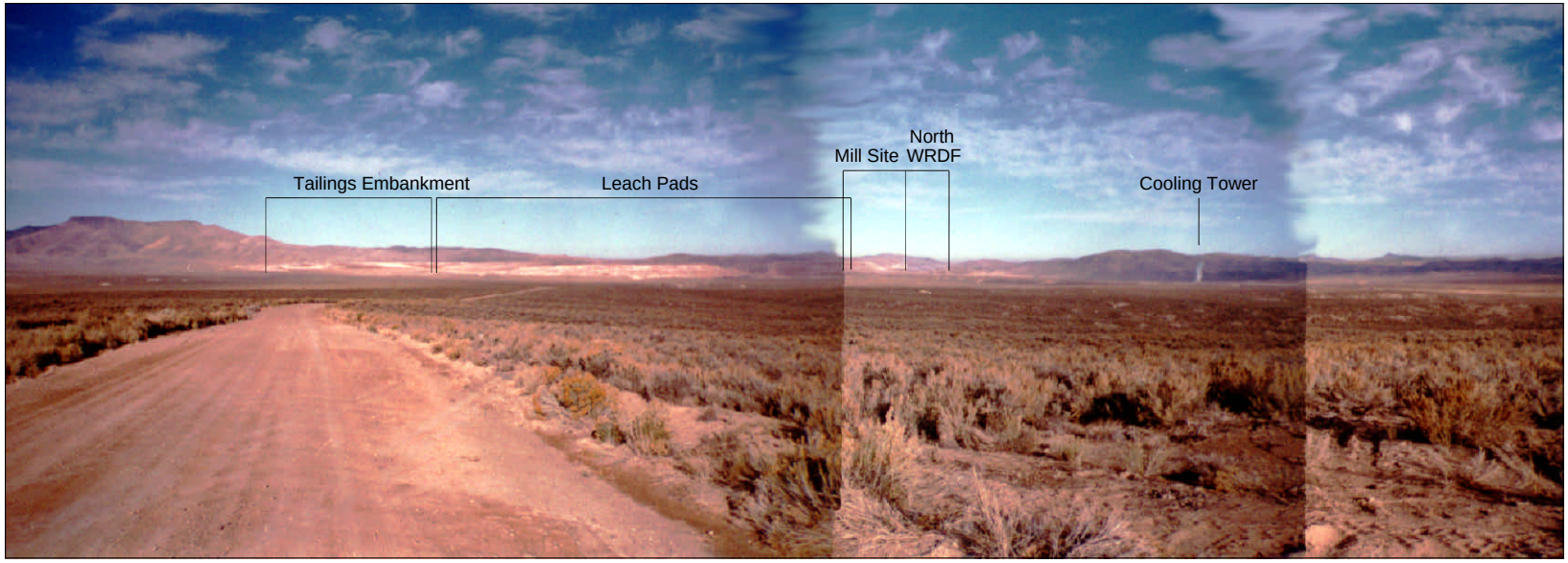


Figure 4- 22a
Existing conditions from KOP4, SOAPA Project

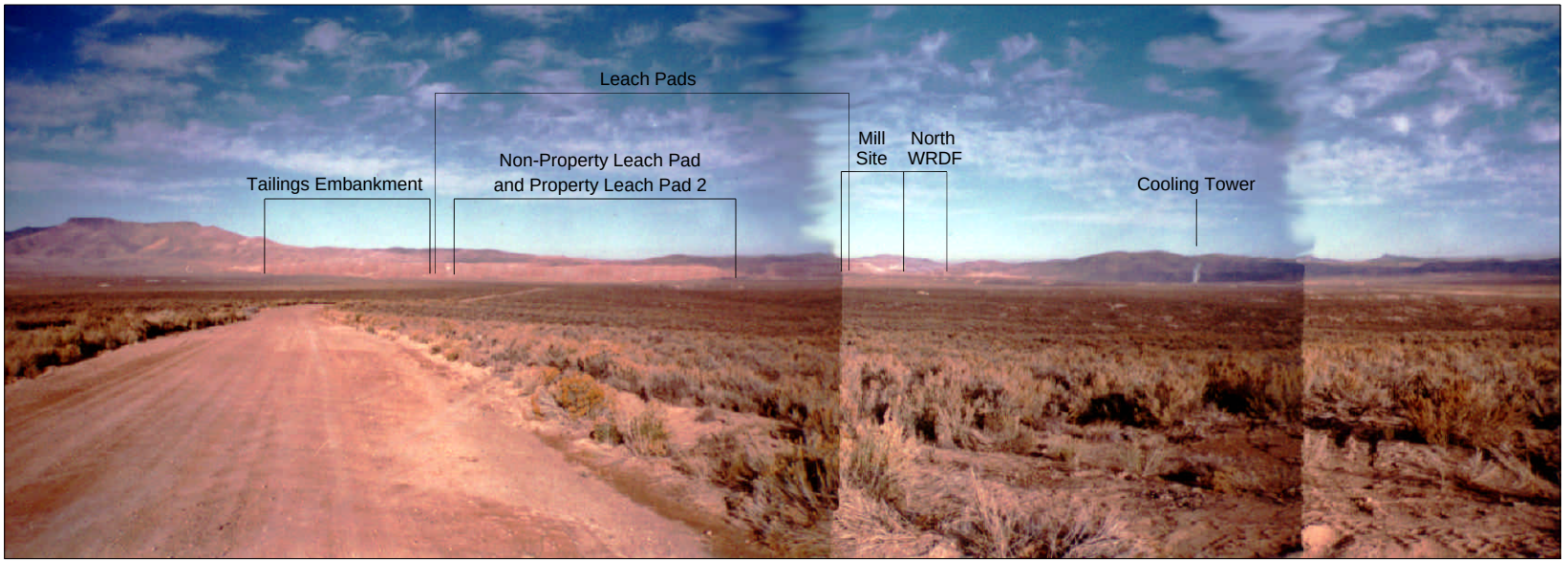


Figure 4- 22b
Peak Mining Conditions from KOP4, SOAPA Project

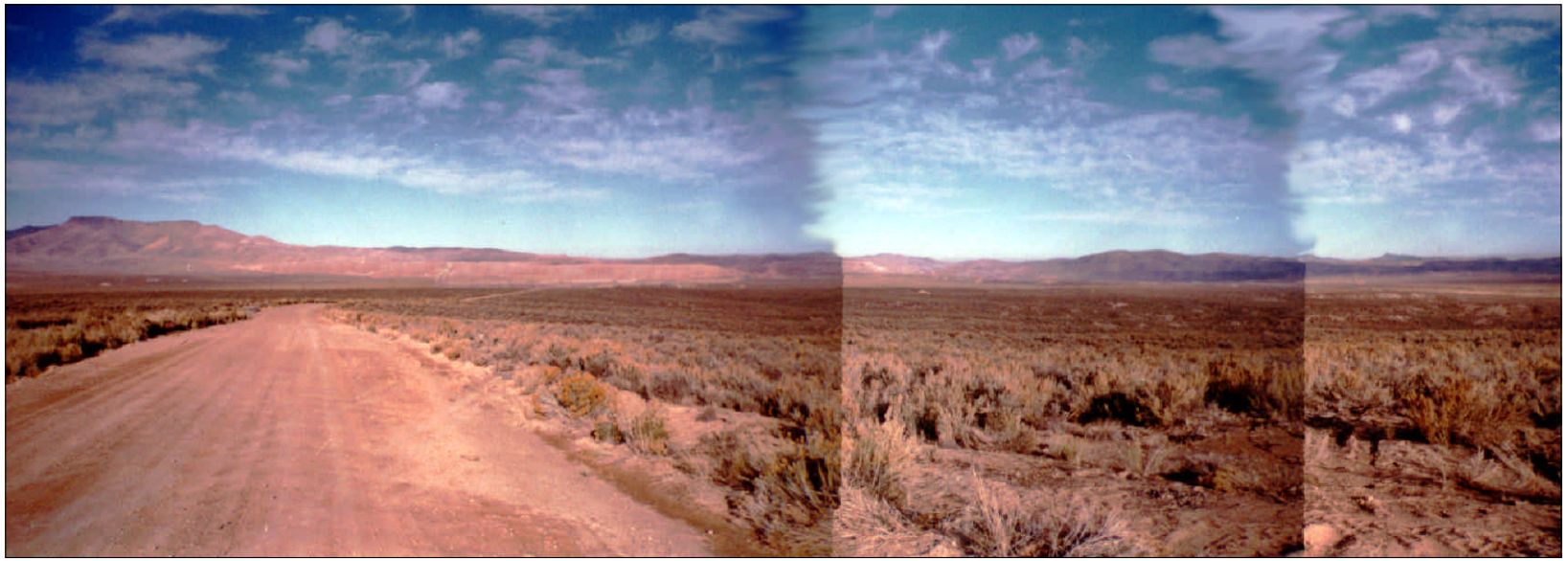


Figure 4- 22c
Post-reclamation conditions from KOP4, SOAPA Project

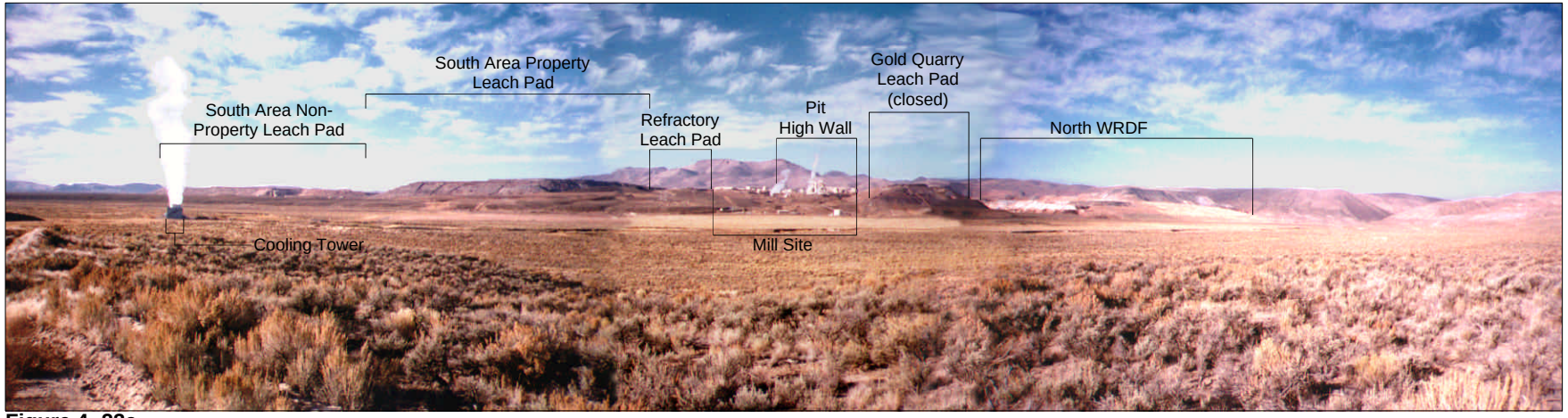


Figure 4- 23a
Existing conditions from KOP6, SOAPA Project

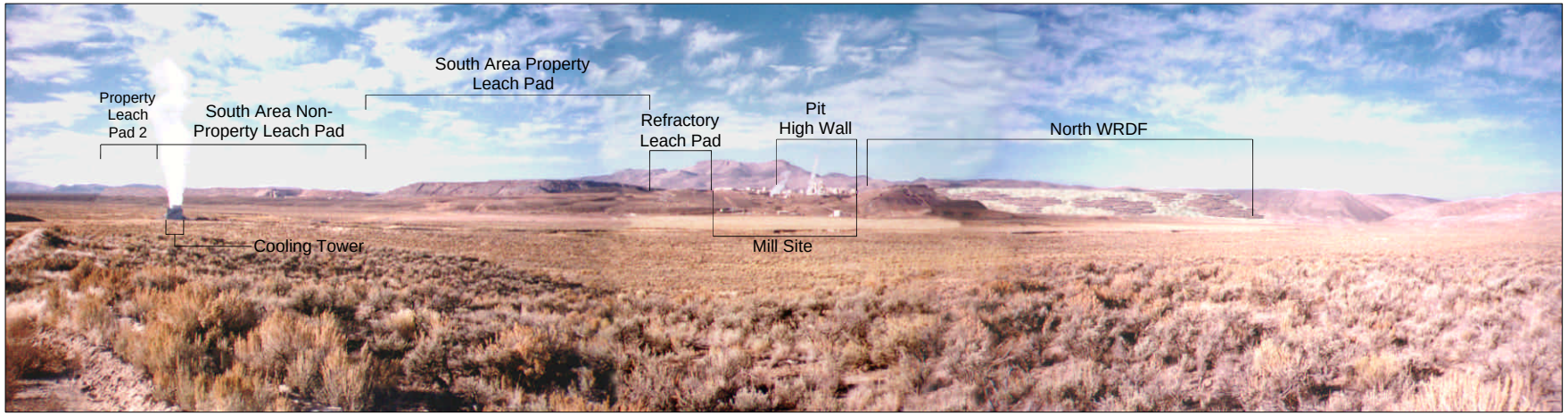


Figure 4- 23b
Peak mining conditions from KOP 6, SOAPA Project

Figure 4- 23c
Post-reclamation conditions from KOP6, SOAPA Project

However, the proposed expansion of the Gold Quarry North WRDF is farther to the west (1.5 miles) and the proposed expansion of the Non-property Leach Pad and construction of the Property Leach Pad 2 would be more than three miles to the south.

The proposed expansion of the Gold Quarry North WRDF would screen some natural features as seen from KOP 6, but would also partially screen the pit high wall. The Proposed Action would extend the existing lines and forms, especially to the south where facilities in Section 18 would extend the long unbroken line by a little more than one-half mile.

The project would increase the physical extent of visual effects but would not introduce stronger degrees of contrast than what currently exists, nor would it introduce new types of land forms, colors, or textures. Revegetation would provide similar colors and textures to those that occur naturally (**Figures 4-21c, 4-22c, and 4-23c**).

Elevating the Gold Quarry North WRDF would essentially raise the skyline behind the existing transmission line and serve to provide more screening and less "skylining" of the transmission line when viewed from KOP 6. The transmission line would remain in place to serve customers located north of the SOAPA area.

Class IV objectives permit high levels of change to the characteristic landscape and visually dominating project activities. Consequently, views of the Proposed Action from KOP 6 would comply with these standards. Class IV objectives do, however, require that every attempt be made to minimize the impact through repeating the elements of line, form, color, and texture, and these are to be addressed by the approved Reclamation Plan.

Night-lighting required by the Proposed Action activities would result in a visible glow apparent within and around the project area including all three KOPs, during the life of mining and processing. The incremental increase in night lighting required for safety and security at the new facilities proposed for SOAPA would not be sufficient to increase the magnitude nor extent of the existing visible glow that is apparent within and around the project area, including all three KOPs. The proposed action would extend the presence of the existing glow until 2011. Following ore processing, lighting would be removed during the reclamation period until all lighting was removed.

Alternatives

Backfilling of the Mac Pit

The Mac pit backfill alternative would not increase the visual impact of structures in the proposed action. The alternative to backfill the Mac pit would reduce the size of WRDFs by about six acres, which would not be noticeable. Backfilling the Mac pit with waste rock from the Gold Quarry pit would result in a minor reduction (less than a 50-foot lift on the North and South WRDFs) in the height of the other WRDFs. The Mac pit would contain approximately 2 percent of the waste rock to be generated by the SOAPA project. Backfilling the Mac pit would not provide any visual benefits, as it is not visible from any of the KOPs. Impacts on visual resources would remain essentially the same as those resulting from the Proposed Action. The alternative to modify the WRDFs would reduce surface disturbance by approximately 50 acres. The

reduced surface disturbance would be in the southwest part of the project area and unlikely to be noticeable from any of the KOPs.

Modified Waste Rock Disposal Facilities

The modified WRDF Alternative, by placing an additional 50-foot lift on top of the Gold Quarry South WRDF, would create a taller and somewhat narrower landform than the Proposed Action. This would make the Gold Quarry South WRDF more noticeable from KOPs 1 and 4 than would the Proposed Action.

The alternative to modify the WRDFs would reduce surface disturbance by approximately 50 acres. The reduced surface disturbance would be in the southwest part of the project area and unlikely to be noticeable from any of the KOPs.

No Action Alternative

Under this alternative, only those kinds of actions currently permitted would continue. It would not, however, reduce the degree of visual disturbance already existing from ongoing activities at the site. As mining operations cease, the project area would be reclaimed according to the current reclamation plan. This would result in reduction of the visual impacts of existing disturbance. Additional visual impacts from the Proposed Action or alternatives would not occur.

Potential Mitigation and Monitoring

Mitigation measures have been developed to minimize visual impacts. The objective is to reduce visual contrasts and is based on three concepts: (1) siting facilities in less visible areas; (2) minimizing disturbance; and (3) repeating the basic elements of form, line, color, and texture. In addition to measures included in the Proposed Action, the following measures could be applied to minimize visual impacts of the proposed action and alternatives:

- Slope gradients on embankments (between 3H:1V and 2.3H:1V) could be varied to create diversity of form and reflect the naturally rolling, rounded forms of the existing topography. This would also provide more diversity for vegetative communities.

- Edges of embankments could be rounded to reduce the angular appearance and soften edges or by dumping dark materials on top of light-colored materials.

- Contrasts in color of bare rock surfaces could be minimized by using commercially available chemical staining agents.

- Clearly defined construction limits should be established. Construction limits should use irregular shapes that reflect existing forms and patterns.

- Revegetation should be planned so that colors and textures blend with undisturbed lands. A mosaic of vegetative types would be preferable to monocultures.

- When additional lighting is added to new facilities, mitigation against nighttime light and glare can be provided by ensuring that new lighting is hooded to direct illumination downward and inward toward the facility, and by keeping the lighting supports as low as reasonable.

In 1993, Newmont agreed to incorporate landscape considerations in final landform design to ensure stable landforms which are geomorphologically congruous with adjacent topography. This mitigation measure would not be implemented until the last years of mining operations.

Irreversible and Irretrievable Commitment of Resources

An irretrievable commitment of visual resources would occur during the active mining period (approximately 10 years). Impacts on visual resources would be reduced through implementation of the proposed mitigation measures.

Residual Effects

Following successful implementation of reclamation measures, the most noticeable residual effect of the Proposed Action and alternatives would be contrasts in form, line, and color which would remain. Weak contrasts would result from the prismoidal forms and straight lines of the reclaimed waste rock storage embankments, tailing impoundments, and leach pads. Finer and more uniform soils in these areas would also create weak contrasts in texture with the existing landscape. A small area of the upper highwall of the Gold Quarry pit could be visible from KOPs 4 and 6 (**Figures 4-21c and 4-22c**).

NOISE

The SOAPA project would result in a continuation of noise generated by mining and ore-processing activities. The noise generated would not impact the town of Carlin, the closest sensitive receptor to the South Operations Area Project.

Direct and Indirect Impacts

Proposed Action

Major sources of noise from the SOAPA project would be the same as those from the existing mining and processing operations rock drilling, blasting, loading of waste rock and ore, truck hauling, and ore crushing and milling. The same types of equipment currently in use would continue to be used for the mine expansion. Blasting in the Gold Quarry pit would be concurrent and occur once a day but noise levels would decrease as pit depth increases. It is assumed that the human and wildlife populations have acclimated to the existing noise levels over the past seven years.

Alternatives

Noise levels would increase slightly south of the project boundary with the construction and operation of the Property Leach Pad and expansion of the refractory and Non-Property leach pads. This slight change in location of project noise would be partially offset by the increased depth of the Gold Quarry pit. Noise from drilling, blasting and mining operations in the mine pit would be muffled by the ever increasing height of the pit walls.

No Action Alternative

Under the No Action alternative, mining operations would cease around 2001. Noise levels would gradually decrease during the reclamation process, and then return to pre-mining levels after reclamation is complete.

Potential Mitigation and Monitoring

No mitigation or monitoring for noise effects would be necessary.

Irreversible and Irretrievable Commitment of Resources

There would be no irreversible or irretrievable commitment of resources as a result of noise effects from the Proposed Action.

Residual Effects

There would be no residual effects to the public resulting from noise generated during operations, and after mine closure, noise would be reduced to much lower levels.

LAND USE AND ACCESS

Direct and Indirect Impacts

Proposed Action

The South Operations Area Project Amendment consists of Newmont-controlled disturbance areas adjacent to mostly public lands managed by the BLM. The public lands support primarily grazing activities and include small amounts of disturbance from historical mining activities. Direct impacts to land use result from the disturbance area required by proposed mine facilities. Indirect effects to land use affect the area surrounding the project.

Under each action alternative, mining and mineral exploration would be the predominant land uses during the life of the project. The amount of ore mined would be similar under each action alternative.

Post-mining land use objectives include providing for wildlife habitat, livestock grazing, recreational use and the restoration of an aesthetically pleasing viewshed that is compatible with the natural setting. These post-mining land use objectives would be accomplished on public lands through implementation of a reclamation plan approved by the BLM. Reclamation on private lands would use the same reclamation plan but could be modified by landowner wishes.

Land Status

Most of the mining and processing facilities in the South Operations area are on private lands owned or controlled by Newmont. The proposed facilities would extend onto federal lands administered by the BLM Elko Field Office and on Newmont-controlled private property. **Table 2-5** summarizes the incremental disturbance acreage for each proposed facility expansion on public and private lands. The proposed surface disturbance on public lands is 839 acres, or 60 percent of the total proposed disturbance of 1,392 acres. Disturbance on private land accounts for the remaining 553 acres (40 percent). This is a 15 percent increase over the existing and permitted surface disturbance of 7,960 acres.

Land Use

Existing land use in the South Operations area is primarily mining and ore processing. The primary effects of the Proposed Action on land use would be to extend the duration of mining operations through the year 2011 and to increase the acres of disturbance from mining activities. Other land uses within and adjacent to the South Operations Project Area include grazing and wildlife habitat. The impacts to wildlife are discussed in Chapter 4 - Terrestrial Wildlife. Grazing is analyzed in

the Livestock Grazing section of Chapter 4. Recreation is not a significant land use of the South Operations Area, as discussed in Chapter 3 - Recreation.

Land use within the proposed disturbance areas adjacent to existing mine disturbance would shift temporarily to mineral development for the life of the mine. Areas surrounding active operations and reclaimed mining areas would continue to serve as wildlife habitat and grazing land during project operations. Land uses requiring public access would be excluded from plans for post-mining reclamation. Reclamation and final closure of mining operations would reestablish the land uses of grazing and wildlife habitat in the disturbance areas under all of the action alternatives.

The federal oil and gas lease and gas pipeline would not be affected, as the pipeline carrying gas from the lease is existing and has been accommodated in project planning. The four utility rights-of-way would also not be affected. There may be need for minor relocations of the utilities for telephone, power distribution lines, and Newmont's natural gas pipeline, but such relocations would be instituted at Newmont's request and paid for by Newmont in negotiations with the utility suppliers. After operations cease, the telephone lines, power distribution lines to the mining operations, and the gas supply pipeline would be removed. The road right-of-way (Highway 766) would remain as would the Sierra Pacific powerline across the northern portion of the project area.

Public Access

Land uses such as recreation and grazing are directly related to the availability of access to public lands. Standard Newmont procedures for developing access roads are to limit service and access roads to nonsensitive locations that avoid critical wildlife habitats.

There would be no change in public access on existing roads from any action alternative. Public access into the South Operations Project Area would remain the same as access available under existing conditions. Public access into the area would be provided by two corridors that would be designated from State Highway 766.

Reclamation and final closure of mining operations would reestablish public access into portions of the disturbance areas under all of the action alternatives. Public access would be restricted around the pits for safety reasons.

Land Use Planning and Management

NEPA implementing regulations require discussion of possible conflicts with federal, regional, state, and local land use plans (40 CFR 1502.16(c)). The Proposed Action would be consistent with the Elko Resource Management Plan (BLM, 1987), which provides for multiple land uses. The Proposed Action would also be consistent with the Elko County Federal Land Use Plan. There is currently no land use plan for Eureka County.

Alternatives

The effects on existing land uses and management policies from the mine expansion are similar for each action alternative. All of the new disturbance acres in each action alternative would be removed from existing land uses of grazing and wildlife habitat. Proposed disturbance acres would also occur on land previously disturbed by the mining operation.

Backfilling of the Mac Pit

The alternative would consist of the same major project components as described for the Proposed Action. This alternative would result in the same number of disturbance acres on public and private lands as the Proposed Action except the backfilled pit would provide 40 acres of wildlife and grazing habitat on public land and six fewer acres of waste rock disposal facility disturbance.

The effects on existing land uses and public access opportunities from the implementation of this alternative would be identical to those described for the Proposed Action.

Modified Waste Rock Disposal Facilities

The Modified WRDF alternative would incorporate a different approach for handling waste rock disposal. Implementation of the alternative would result in WRDFs with slightly smaller footprints (53 acres). All other components are the same as those identified in the Proposed Action. The effects on existing land uses and public access opportunities from the implementation of this alternative would be identical to those described for the Proposed Action.

No impacts to existing land uses would occur under this alternative and no additional ore would be produced from the South Operations area once permitted operations have been completed. The existing condition of BLM lands in the South Operations area would be maintained under the current management direction as defined in the BLM Land and Resource Management Plan. It is expected that the existing mining operations at Gold Quarry would continue for the current mine life through the year 2001.

No Action Alternative

Mining operations have resulted in the restricted access to public lands in the vicinity of mine facilities for public safety. Under the No Action Alternative the existing mine area closed to public access would remain closed until final reclamation of the existing mine operations is completed and public access restrictions are lifted. Portions of the closed area may have been accessed prior to mining for grazing or recreation purposes. The closures would continue under this alternative until mining has ceased and reclamation is complete.

Potential Mitigation and Monitoring

In the 1993 Mitigation Plan for the South Operations Area Project (BLM, 1993), Newmont developed a reclamation plan with the goal of achieving the objectives of multiple land use. No additional mitigation is proposed.

Irreversible and Irretrievable Commitment of Resources

Lands removed during the expansion of the Gold Quarry pit would be irreversibly and irretrievably lost for future land uses.

Residual Effects

With the exception of the pit expansion, there would be no residual effects on land use following mine closure. Reclamation of surface disturbances would restore lands to post-mining land uses, including wildlife habitat and grazing.

CULTURAL RESOURCES

Direct and Indirect Impacts

This discussion will consider four alternative actions and their potential impacts to significant cultural resources: (1) the Proposed Action; (2) Backfilling of the Mac Pit; (3) Modified Waste Rock Disposal Facility; and (4) No Action. None of these alternatives would entail direct impact to significant cultural resources. In all cases the significant cultural resources are located in areas peripheral to the proposed actions or operations. Traditional cultural properties and areas of traditional cultural concern have also not been identified within the area of direct effect.

Proposed Action

The Proposed Action Alternative entails expansion of the Gold Quarry pit, additional topsoil piles, expansion of waste rock disposal facilities and modification of diversion ditches, as depicted in **Figure 2-3**. Six of the seven significant cultural resources are east of State Route 766, away from the proposed operations. The Proposed Action would not involve any new earthmoving disturbance in this area, and would not adversely affect any of these cultural resources. Site CRNV-12-3283 is in an area that is near proposed waste rock disposal facilities and diversion ditches. Although this site would not be directly impacted by the Proposed Action, there could potentially be indirect degradation of the resource as a result of increased traffic and activity in the vicinity. The Nevada State Historic Preservation Office has recommended that the latter site be protected by staking or signing an avoidance area around the property (Nevada State Historic Preservation Office, 1997).

Alternatives

Backfilling of the Mac Pit

Backfilling of the Mac pit with waste rock from the expanded Gold Quarry pit would reduce the needed extent of waste rock disposal facilities. Again, site CRNV-12-3283 might only be indirectly impacted by increased activity in the vicinity.

Modified Waste Rock Disposal Facilities

The Modified Proposed Action would entail modifications to the location and extent of facilities, stockpiles and ancillary disturbance as described in the Plan of Operations. The potential adverse impacts to significant cultural resources would be the same as described above for the Proposed Action Alternative.

No Action Alternative

The No Action Alternative would entail no expansion of the SOAPA project. This would not result in any direct or indirect impacts to significant cultural resources.

Potential Mitigation and Monitoring

All but one of the significant cultural resources are located outside the areas of proposed new mining disturbance. SHPO has recommended that site CRNV-11-3283 be protected by the staking or signing of an avoidance area around the documented extent of the resource (Nevada State Historic Preservation Office, 1997). A visible barrier at least 30 meters from the perimeter of the site is recommended to clearly demarcate an area

where traffic or earth disturbing activities are prohibited. SHPO concludes that adherence to these stipulations would result in no effect to this significant property.

Irreversible and Irretrievable Commitment of Resources

Cultural resources represent a finite resource which cannot be replaced. Therefore, any disturbance that results in their destruction would constitute an irreversible and irretrievable commitment of resources.

Residual Effects

It has been amply demonstrated at other projects that the construction of new access roads into an area that has been difficult to access in the past provides unauthorized artifact collectors access to cultural resources that might otherwise remain inaccessible.

NATIVE AMERICAN RELIGIOUS CONCERNS

Consultation with the Western Shoshone occurred in two phases. Phase I involved consultation concerning the proposed areas of disturbance for the SOAPA project. No specific areas of religious or traditional importance were identified to the BLM in the direct impact area of the SOAPA.

In addition, Deaver (1993) found that:

1. Current use of the area of direct effects for spiritual or ceremonial purposes appears to be nonexistent (Deaver, 1993 page 44).

2. No cultural properties within the area proposed for mine expansion appear to fit the formal definition of traditional cultural properties (Deaver, 1993 page 46).

3. While human skeletal material (a mandible and 10 isolated teeth) was recovered in 1984 during the archaeological excavation of a rockshelter in the area, surveys in the area of direct effects have yielded no further evidence of graves (Deaver, 1993 page 46). Likewise, surveys in the area of direct effects have identified no associated funerary objects, unassociated funerary objects, sacred objects, or objects of cultural patrimony.

4. The South Operations Area is within the traditional territory of the Newe/Western Shoshone, and within the boundaries of the lands covered by the Treaty of Ruby Valley. Although specific properties or areas of concern have not been identified within the South Operations area, many traditionalist Newe/Western Shoshone maintain that they never ceded their traditional lands, and that they retain jurisdiction over public domain in this area. In the traditional worldview, disturbances such as mining disrupt the flow of puha (spiritual power) and lead to a dissipation of spirit life and degradation of sacred spring water. Some of the traditional value of the land is irreplaceable, but some measure of the loss of traditional resources can be lessened by reintroducing important native plants and animals in the reclamation plan (Deaver, 1993 page 45).

Phase II of the consultation effort involved potential impacts to Western Shoshone religious and traditional areas as a result of mine dewatering. **The Cumulative Impacts Analysis document (CIA) noted a potential future effect to the Rock Creek drainage as a result of the cumulative effects of mine**

dewatering. Reductions in the amount of water flowing through the middle portion of the Rock Creek drainage could have an adverse effect on the Rock Creek Traditional Cultural Property. However, the hydrogeologic models used for simulating dewatering indicate that dewatering associated with SOAPA would not contribute to expansion of the cumulative cone of depression from all three mines to the north or west and hence, would not contribute to any future loss of water from the Rock Creek drainage basin (BLM, 2000b and 2000e).

In addition, the CIA indicates that the cumulative effect of mine dewatering will not have an effect on the Tosawihi Quarries Traditional Cultural Property. First, the models indicate that mine dewatering will not extend as far north as the springs that are associated with the Tosawihi Quarries Traditional Cultural Property. Additionally, water data indicate that the springs associated with the Tosawihi Quarries Traditional Cultural Property are connected to perch aquifers isolated from the deeper aquifers which may be effected by mine dewatering. Put another way, springs within the Tosawihi Quarries Traditional Cultural Property depend on annual precipitation which maintain shallow, near-surface aquifers, and would not be effected by any mine dewatering of deep regional aquifers. In this direction also, the SOAPA Project does not contribute to any expansion of the ultimate cone of depression.

Potential Mitigation and Monitoring

No direct or indirect effects on Newe/Western Shoshone traditional cultural values, practices, properties, or human remains are anticipated in the Gold Quarry area as a result of any of the proposed action alternatives. Therefore, no mitigation or monitoring measures have been proposed in the Gold Quarry area. **Because the SOAPA will have no direct effect on the two identified TCPs no monitoring or mitigation plans related to the TCPs are proposed for this project.**

Irreversible and Irretrievable Commitment of Resources

Since no direct or indirect impacts on Newe/Western Shoshone traditional values, practices, properties, or human remains and cultural items are anticipated in the Gold Quarry area as a result of the Proposed Action, no irreversible or irretrievable commitment of resources is anticipated in this region. **The BLM does not view the cumulative effects of the project as constituting an irreversible and irretrievable commitment of resources.**

Residual Effects

The continuation and expansion of mining, and the associated dewatering, at the Gold Quarry Mine "will contribute to the dissipation [sic] of puha and spirit life in the area" (Deaver, 1993:44). Increased traffic directly associated with the mining activities, and improvement of access would contribute to increased intentional and casual activity at significant cultural resource locations, to the degradation of biotic and mineral resources traditionally valued by the Newe/Western Shoshone, and to the disturbance of spirit life in the area. Dewatering activities affect spring and surface water flows within the proposed operations area, and throughout a wide surrounding area. The latter disruption of spring and surface water flows would affect the distribution of plants, animals and spirits important to the Newe/Western Shoshone.

There are no known ways to lessen disruption of spirit life or restore mineral resources affected by mining activities and dewatering, but traditionally **valued animals can be included in the mitigation plan. The Western Shoshone have expressed their concern about the declining numbers of sage grouse in the region. Sage grouse are considered a sacred bird to the Western Shoshone, and a loss of this species could adversely effect their spiritual way of life. The mitigation plan for this project will minimize raptor predation (Chapter 4, Terrestrial Wildlife, Potential Mitigation and Monitoring). This mitigation effort includes a 139-acre seeding for the restoration of sage grouse habitat.**

Residual effects to Newe/Western Shoshone traditional values and practices may occur in the Gold Quarry area as a result of the Proposed Action, but these effects are expected to be minor to negligible because consultation with the Western Shoshone has not specifically identified this area as an important spiritual or religious area. **Potential residual effects resulting from the cumulative effects of mine dewatering are expected to be temporary in nature, as the dewatering models indicate that 90 percent recovery of the water table in about 30 years following cessation of dewatering at Gold Quarry (Figure 4-15). Springs and seeps that may be effected by mine dewatering at the SOAPA should begin to recover once the dewatering operation ceases.**

SOCIAL AND ECONOMIC RESOURCES

Newmont projects that no additional permanent employees would be hired during the operational phase of the project. The South Operations Area Project Amendment would continue to affect local communities through continued retail sales and employment.

Economic impacts during operational phases of the project would include continued employment in the mining industry and secondary jobs in retail and service industries. In the event that additional employees are hired during the operational phase, any previously laid-off employees would be considered for employment. Income would continue to be produced, primarily in Elko County, from wages paid in mining and secondary jobs created by the Proposed Action.

Impacts to the local economy would also occur once the operational and reclamation phases of the project are completed under any action alternative. Closure of the mine could contribute to an overall decline in mine production in the counties. There would be an expected decrease in jobs, and decreases in payrolls, purchases, and tax payments. These declines could result in out-migration and community instability, and negative effects on County revenues. In addition, businesses may close or relocate outside of the counties, home values could decline, and the quality of life may decrease.

Direct and Indirect Impacts

The proposed plan of operations amendment for the South Operations Area Project includes the continued operation of the Gold Quarry Mine through the year 2011. While the project includes the expansion of existing facilities and the installation of several new project components, the Newmont Gold Company proposes to utilize the existing work force to initiate work on the expansion.

The amended plan of operations is not expected to increase the number of permanent

operational personnel. The most notable effects of the amendment would be an extension of existing employee needs for housing and services in the cities of Carlin, Elko, and the community of Spring Creek through the year 2011, when the number of employees is expected to be reduced to levels required to decommission the operation and perform reclamation. Mine employees could contribute to city and county growth revenues through 2011. The extension of receipts of income generated from property, sales, and net proceeds taxes from the mine to city and county revenues are also expected to continue but at a reduced level, through 2015. Newmont projects that no additional permanent employees would be hired during the operational phase of the project. The number of permanent employees is expected to be kept at a relatively constant level.

Economic impacts during operational phases of the project would include continued employment in the mining industry and secondary jobs in retail and service industries. Income would continue to be produced, primarily in Elko County, from wages paid in mining and secondary jobs created by the Proposed Action.

Most property taxes and net proceeds of mining taxes would be paid to Eureka County, whereas most sales tax revenues would accrue to Elko County. Commercial and residential development induced by mine expansion in Elko County would increase revenues from property and sales taxes.

Proposed Action

Employment

Newmont proposes to use the existing work force to initiate work on the proposed project. No increase in permanent employment is anticipated with implementation of the proposed action. Newmont employs a total of about 2,950 workers in Nevada, of which they estimated that 1,000 workers are employed at the South Operations area. The existing workforce would also be utilized during the construction phase of the project, supplemented with independent contractors, numbering no more than 100 workers. The Proposed Action, together with other Newmont activities, would provide for long-term operations in this area, leading to a potential for stable employment for approximately 15 years.

Housing

Implementation of the proposed project is not expected to alter existing housing conditions or to create a need for additional housing in the project area.

Community Service Providers

The SOAPA project would have negligible impacts on government in Elko and Eureka counties. Over the last decade, city and county governments have functioned in an environment of rapid growth with stresses caused by increased population and demands for community services. Demands on government would not appreciably change with the Proposed Action.

It is not anticipated that any significant changes in demand for schools, or other public services such as law enforcement, fire protection, health care, or social services would be realized as a result of the Proposed Action. In addition, the project would not affect water, wastewater, solid waste or parks and recreation. To the extent that there are existing service deficiencies with regard to ambulance services as well as mental health services, these conditions would not be

worsened by the proposed Newmont operations. Additionally, area school districts have become readily adaptable to changing student enrollments and frequently use modular facilities as necessary.

Government and Public Finance

The Proposed Action would result in an extension of mining activities at the Gold Quarry Mine through the year 2011. The proposal does not include an increased rate of production but instead proposes an extension of mining activities to the year 2011. Subsequently, revenues in the form of net proceeds of minerals tax, property tax, and sales and use taxes, would continue to be collected by Eureka and Elko Counties, as well as the State of Nevada.

In 1996, revenues paid to Eureka County from net proceeds of mining taxes amounted to approximately $3.8 million for the year. Sales and use taxes paid to the state attributable to Newmont projects totaled $13.8 million. Property taxes after construction are not known because assessed valuation is not known; however, property taxes would exceed the $3.6 million paid to Eureka and Elko counties in 1996.

Additionally, the Newmont project would continue to contribute to the local economy through sales taxes generated from employee spending. Sales taxes would be divided primarily among Elko County (Nevada), Salt Lake City (Utah), Twin Falls (Idaho), and Reno (Nevada), the areas where local residents most often purchase major items. Also, it can be assumed that wages paid in the mining industry would induce additional jobs in other economic sectors (Dobra, 1988).

Alternatives

Impacts on social well-being, community services, and housing in the study area with these alternatives would be essentially the same as under the Proposed Action. Impacts on economic resources in the study area with these alternatives would also be the same as under the Proposed Action.

No Action Alternative

With the No Action Alternative, existing mining would continue until 2001. After that date, the majority of the operational work force would be laid off. A limited number of employees would be retained to decommission the operation and perform reclamation.

With cessation of mining at the South Operations area, the population of Elko County would eventually decline. More housing would become available and prices for buying or renting would decrease. Traffic also would decrease. Existing diversification of the local economy would help mitigate the effects of the mine closure.

Crime and other indicators of decreased social well-being (e.g., divorce, domestic abuse, suicide, alcohol and other drug abuse, and welfare rates) would probably increase in the short term after mining ceases. Eventually, the community would adjust to the loss of population and economic benefits. As previously discussed, boom-and-bust cycles have been part of the social history of the Elko area.

Reduction of the operational work force would increase unemployment rates, reduce wages, decrease taxes paid to Eureka and Elko counties, and stress public assistance programs. Many workers would likely remain

in the Elko area and seek work at other mines, while others would move from the area.

Potential Mitigation and Monitoring

No specific mitigation measures are required by NEPA and none are proposed.

Irreversible and Irretrievable Commitment of Resources

There would be no irreversible and irretrievable commitment of socioeconomic resources associated with the Proposed Action or alternatives.

Residual Effects

Residual impacts would be as described under direct and indirect impacts.

WASTES - SOLID OR HAZARDOUS

Direct and Indirect Impacts

Proposed Action

No direct impacts from wastes, solid or hazardous, are expected from the Proposed Action because Newmont would continue to dispose of its non-hazardous solid wastes in its own permitted landfill or have wastes transported to the Elko County landfill. All hazardous wastes that would be generated on-site would be handled according to existing approved permits or would be disposed of according to local, state, or federal regulations. The Proposed Action would have the indirect impact of contributing wastes to the Elko and Eureka county landfills at a rate higher than prior operations.

For the first three quarters of 1999, Newmont reported to the NDEP an average of eight spills per quarter of all materials, liquid and solid, hazardous and non-hazardous, even including fresh water. Almost all spills were inside process buildings, a few were to soils, but none were to natural waters or waterways. The most numerous of these spills was of weak solution of sodium cyanide used in processing (about four spills per quarter). The NDEP report form calls for spills to be documented in pounds of material spilled. On that basis, the average spill of sodium cyanide was 0.27 pounds per spill (roughly 400 to 500 gallons of solution). Other hazardous materials spilled included ammonium thiosulfate, lime (solid and in solution), sulfuric acid, and hydrochloric acid. All spills were contained and cleaned up in an appropriate manner according to state and federal regulations.

Newmont would continue to process ore under SOAPA at the same rate as at present. This means there would be no increase in the volumes or frequency of truck traffic carrying solid or hazardous wastes. As a result, no change in the truck accident rate, or in the frequency of spills of materials is anticipated. However, by extending mining and **processing for another ten years, the proposed action would continue to experience minor spills for a longer time than under the No Action Alternative.** Newmont has prepared a Spill Prevention Control and Countermeasures Plan as part of their designation as a major generator of hazardous wastes. The spill control plan would continue to be implemented as the major means of avoiding spills and properly cleaning up those that do occur.

Alternatives

No impacts from wastes would be expected from either of the alternatives because all processes which generate or handle wastes would be the same as the Proposed Action.

No Action Alternative

No impacts from wastes are expected from the No Action Alternative because all wastes from the existing operations are being handled according to local, state, or federal regulations. An indirect impact would occur in that solid, non-hazardous wastes would not contribute to the filling of county landfills at a rate any different than at present.

Potential Mitigation and Monitoring

No additional mitigation or monitoring measures are proposed beyond those currently being implemented by Newmont.

Irreversible and Irretrievable Commitment or Resources

No irreversible or irretrievable commitment of resources would occur as a result of the waste generating and handling procedures that are an integral part of the Proposed Action or alternatives.

Residual Effects

There would be no residual impacts from wastes generated by the Proposed Action or alternatives, with the exception of the indirect impact to county landfills.

ENVIRONMENTAL JUSTICE

The Proposed Action and alternatives do not have any potential for infractions of the Executive Order directing agencies to address Environmental Justice. This is because the project is in an area removed from any population centers or concentrations of any minority or low income persons, and secondly, it is an expansion of a currently permitted facility in a mining region and does not propose the location of new facilities that would affect persons in their residential communities.

COMPARISON OF IMPACTS

Table 4-7 summarizes and compares impacts between the Proposed Action and the alternatives, including the No Action Alternative. The Agency Preferred Alternative has been identified as the Proposed Action. Detailed descriptions of impacts are contained in previous sections of Chapter 4. Under the No Action Alternative, existing mining operations would continue through 2001 as approved by the BLM (1993) and associated impacts of these actions constitute existing conditions to assess SOAPA.

Table 4-7 can also be used to compare impacts predicted in 1993 with the predicted impacts of the proposed amendment. Impacts predicted in 1993 are presented under the No Action column, as those impacts either have, or would be expected, to occur by 2001. The text of this EIS mentions certain exceptions where impacts from 1993 have not materialized.

TABLE 4-7
COMPARISON OF IMPACTS BETWEEN THE PROPOSED ACTION AND ALTERNATIVES

		Alternatives		
Resource	**Impacts of Proposed Action**	**Alternative 1 Proposed Action w/Backfilling the Mac Pit**	**Alternative 2 Proposed Action w/Modified WRDFs**	**No Action**
Geology and Minerals	Relocation of approximately 526 million tons of rock material. 330 acres of steep slopes would remain. An area identified as susceptible to sinkhole development occurs within the predicted 10-foot drawdown contour.	Elimination of access to ore resources in the Mac pit. Slightly smaller (6 acres) WRDFs.	Similar to Proposed Action but with slightly smaller (53 acres)but taller (50 feet) WRDFs.	Loss of recovery of several million ounces of gold reserves. Approximately 526 million tons of ore and waste rock not removed. An area identified as susceptible to sinkhole development occurs within the 10-foot drawdown contour.
Paleontology	Impacts limited to area of disturbance.	Similar to Proposed Action.	Similar to Proposed Action.	No potential effects to paleontological resources.
Air Resources	Air quality would remain at or near present levels in the South Operations Area through 2011with short-term increases in particulates.	Additional diesel and fugitive dust emissions would be generated by increased haul distance.	Similar to Proposed Action.	Air quality would begin to return to pre-mining levels after 2001.
Water Resources - Surface Water Quality	No major impacts to surface water quality. Is potential for increased levels of metals and trace elements in discharge waters.	Similar to Proposed Action.	Similar to Proposed Action.	Existing conditions maintained through 2001.

TABLE 4-7 (continued)
COMPARISON OF IMPACTS BETWEEN THE PROPOSED ACTION AND ALTERNATIVES

		Alternatives		
Resource	**Impacts of Proposed Action**	**Alternative 1 Proposed Action w/Backfilling the Mac Pit**	**Alternative 2 Proposed Action w/Modified WRDFs**	**No Action**
Water Resources - (cont.) Surface Water Quantity	**A continuation of current effects identified in 1993 until the year 2011. Five** additional stream **reaches** could have sections of reduced or eliminated baseflows. The predicted 10 ft drawdown contour would comprise an additional 26,100 acres. **Dewatering would** continue until 2011**, recovery over following decades**.	Similar to Proposed Action.	Similar to Proposed Action.	Eight streams could have sections of reduced or eliminated baseflow. The predicted 10-ft drawdown contour would comprise 151,600 acres. **Dewatering would** continue until 2001**, recovery over following decades**.
Water Resources (cont.) Groundwater Quality	Generally similar groundwater quality in and near Gold Quarry pit after dewatering ceases. Groundwater quality would remain acceptable with water quality standards.	Similar to Proposed Action.	Similar to Proposed Action.	Existing conditions maintained through 2001.
Water Resources (Cont.) Groundwater Quantity	Lowered water table; reduced groundwater outflow rates during and after dewatering. Eleven wells or groundwater rights are predicted to be impacted. Groundwater recovery to start in 2011.	Similar to Proposed Action.	Similar to Proposed Action.	Lowered groundwater levels from current operation. 16 wells predicted to be impacted. Groundwater recovery to start in 2001.

TABLE 4-7 (continued)
COMPARISON OF IMPACTS BETWEEN THE PROPOSED ACTION AND ALTERNATIVES

		Alternatives		
Resource	**Impacts of Proposed Action**	**Alternative 1 Proposed Action w/Backfilling the Mac Pit**	**Alternative 2 Proposed Action w/Modified WRDFs**	**No Action**
Springs and Seeps	Reduced or lost flow in five developed and an unidentified number of undeveloped springs and seeps in the project area.	Similar to Proposed Action.	Similar to Proposed Action.	Impacts to 25 springs and seeps from current operations. All 25 had specific mitigation measures proposed. All springs were fenced and water systems installed. See Appendix A.
Surface Water Rights	12 certificated rights potentially affected by lost baseflows.	Similar to Proposed Action	Similar to Proposed Action	Seven certificated rights potentially affected from current operations.
Floodplains	No detectable effect on Humboldt River floodplain.	Similar to Proposed Action.	Similar to Proposed Action.	Existing conditions maintained through 2001.
Soils	Soils disturbed on 1,392 acres. Topsoil spread on 1,253 acres during reclamation.	Soil disturbed on 1,386 acres. Topsoil spread on 1,247 acres.	Soils disturbed on 1,339 acres. Topsoil spread on 1,200 acres.	Existing conditions maintained through 2001. 7,960 acres disturbed and 6,941 reclaimed.
Vegetation	Removal of 1,392 acres. Revegetation of 1,253 acres.	Removal of 1,386 acres. Revegetation of 1,247 acres.	Removal of 1,339 acres. Revegetation of 1,198 acres during reclamation.	Existing conditions maintained through 2001. 1,573 acres disturbed and 1,376 reclaimed.
Noxious Weeds	Disturbance of 1,392 acres provides invasion sites followed by construction. New construction to remove approximately 45 acres of existing infestation.	Similar to Proposed Action. Disturbance of 1,386 acres.	Similar to Proposed Action. Disturbance of 1,339 acres.	Existing infestations subject to ongoing control methods.

TABLE 4-7 (continued)
COMPARISON OF IMPACTS BETWEEN THE PROPOSED ACTION AND ALTERNATIVES

		Alternatives		
Resource	**Impacts of Proposed Action**	**Alternative 1 Proposed Action w/Backfilling the Mac Pit**	**Alternative 2 Proposed Action w/Modified WRDFs**	**No Action**
Riparian Areas and Wetlands	Disturbance of 0.98 acres of Waters of the U.S. in Section 18. A limited amount of riparian areas along Maggie Creek, tributaries, and Humboldt River could be affected. Loss of less than 2.5 acres of riparian habitat associated with springs and seeps.	Similar to Proposed Action.	Similar to Proposed Action.	Impacts on 1,264 acres of riparian habitat from current operations.
Terrestrial Wildlife	Loss of habitat associated with disturbance of 1,392 acres; reduction or loss of flow in springs and seeps would displace wildlife to adjacent areas. Reclamation would restore habitat on 1,253 acres.	Similar to Proposed Action. Disturbance of 1,386 acres. Additional 40 acres at Mac pit available for wildlife; Total 1,247 acres revegetated.	Similar to Proposed Action. Disturbance of 1,337 acres of wildlife habitat. Total of 1,200 acres revegetated.	Existing conditions maintained through 2001. Similar to Proposed Action, Loss of habitat on 7,960 acres, through 2001. Reclamation on 6,941 acres,
Aquatic Habitat and Fisheries	Potential decreased baseflow in two streams during and after dewatering. Potential increase in total loading of metals and trace elements in waters.	Similar to Proposed Action.	Similar to Proposed Action.	Potential reduction or lost baseflow in 8 streams during and after dewatering. Existing conditions maintained through 2001. Potential increase in total loading of metals and trace elements.

TABLE 4-7 (continued)
COMPARISON OF IMPACTS BETWEEN THE PROPOSED ACTION AND ALTERNATIVES

		Alternatives		
Resource	**Impacts of Proposed Action**	**Alternative 1 Proposed Action w/Backfilling the Mac Pit**	**Alternative 2 Proposed Action w/Modified WRDFs**	**No Action**
Threatened, Endangered, Candidate and BLM Sensitive Species	Lahontan cutthroat trout habitat would not be affected by temporary reductions in baseflow resulting from the continued dewatering program beyond those already occurring. Bald eagle may be exposed to increased levels of metals and trace elements in aquatic prey.	Similar to Proposed Action.	Similar to Proposed Action.	Lahontan cutthroat trout would **not** be **adversely** affected. **Implementation of the 1993 Mitigation Plan, especially the Maggie Creek Watershed Restoration Project (Appendix A), continues to improve LCT habitat in Maggie Creek.** Springsnails potentially affected in 1 spring.
Livestock Grazing	A total of 71 AUMs would be displaced on public lands as a result of surface disturbance for the life of the project and reclamation. Reclamation and recovery of the water table would reestablish most grazing habitat.	Reclamation of Mac pit would add 40 acres livestock grazing (2 AUMs).	Similar to Proposed Action.	Existing conditions maintained through 2001. 8,092 AUMs temporarily displaced.
Recreation	Continued visitation stress on existing recreational facilities in the Elko area.	Similar to Proposed Action.	Similar to Proposed Action.	Cessation of mining in 2001 and a population decrease could reduce visitation on existing recreational facilities in the Elko area.
Visual Resources	Expansion would not create major visual impacts relative to existing facilities.	Similar to Proposed Action.	Similar to Proposed Action.	Existing conditions (large scale modifications to land forms and visible cooling tower plumes) maintained through 2001.
Noise	No change to existing noise levels.	Similar to Proposed Action.	Similar to Proposed Action.	Existing conditions maintained through 2001.
Land Use and Access	Minor modification to land use and access would result.	Similar to Proposed Action.	Similar to Proposed Action.	Existing restrictions maintained until reclamation is complete.

TABLE 4-7 (continued)
COMPARISON OF IMPACTS BETWEEN THE PROPOSED ACTION AND ALTERNATIVES

		Alternatives		
Resource	**Impacts of Proposed Action**	**Alternative 1 Proposed Action w/Backfilling the Mac Pit**	**Alternative 2 Proposed Action w/Modified WRDFs**	**No Action**
Cultural Resources and **Native American Religious Concerns**	No direct impacts to cultural resources. Dewatering may potentially affect traditional values or practices of the Western Shoshone.	Similar to Proposed Action.	Similar to Proposed Action.	Existing conditions (disturbance of 37 cultural resources, three of which are NRHP eligible) maintained through 2001.
Social and Economic Resources	No temporary impacts during the construction period on community services. State and local economic benefits from taxes and commercial activities.	Similar to Proposed Action.	Similar to Proposed Action.	Termination of mining at end of 2001; majority of work force laid-off. Reduction in local economic benefits from taxes.
Wastes - Solid or Hazardous	No significant change in magnitude of waste generation. Waste generation would continue until 2011.	Similar to Proposed Action.	Similar to Proposed Action.	Existing approved waste management practices would continue through 2001.
Environmental Justice	No impacts would occur.	Similar to Proposed Action.	Similar to Proposed Action.	No impacts are occurring.

CHAPTER 5
CUMULATIVE EFFECTS ANALYSIS

CHAPTER 5

CUMULATIVE EFFECTS ANALYSIS

This chapter summarizes the anticipated cumulative effects, both direct and indirect, of implementation of the SOAPA project together with other past, existing, and reasonably foreseeable projects in the Carlin Trend vicinity. These cumulative effects would result from incremental effects of the Proposed Action when added to the effects from other activities along the Carlin Trend.

The cumulative effects analysis was assembled from two evaluations. The first analysis for geology; water resources and geochemistry; wetlands; riparian vegetation; terrestrial wildlife; aquatic resources; threatened, endangered, candidate, and sensitive species; grazing management; socioeconomics; and Native American religious concerns was based on the effects of dewatering and water discharge from mining operations in the Carlin Trend. The BLM document (BLM, 2000b) is a technical report entitled Cumulative Impact Analysis of Dewatering Operations for Betze Project, SOAPA, and Leeville Project. The discussion in this chapter represents summaries of the technical analyses for the above-listed resources.

The second analysis for paleontological resources, air resources, upland vegetation, floodplains, soils, noxious weeds, recreation, visuals, noise, land use/access, waste management, and environmental justice was based on the potential effects of non-dewatering impacts as a result of mining in the Carlin Trend.

The potential cumulative effects of the alternatives to the Proposed Action were not analyzed for two reasons: (1) a review of **Table 4-7** indicates that potential effects from the SOAPA alternatives are not greatly different from the Proposed Action, and (2) analyzing cumulative effects from SOAPA alternatives might suggest that alternatives at the other 30 projects discussed might also have alternatives with different levels of impact that should be analyzed. However, this was considered beyond the scope of the cumulative analyses.

EXISTING AND FORESEEABLE PROJECTS

Figure 5-1, and Tables 5-1 and 5-2 present the existing and reasonably foreseeable projects and related disturbance by mining on the Carlin Trend. This information forms the basis for discussion of cumulative effects for this chapter.

IMPACTS SUMMARY

Geology

Karst Development in the Region

The primary issue identified for this assessment of cumulative geological impacts is the potential for development of sinkholes or other karst-type collapse features that could result from mine-induced drawdown and water management activities. Three sinkholes have been documented to date in the area since dewatering operations were initiated at the Goldstrike and Gold Quarry mines: (1) a sinkhole approximately 3.5 miles northwest of the center of the Betze-Post pit; (2) a sinkhole

approximately 2.8 miles west of the center of the Betze-Post pit located near spring 6; and (3) a sinkhole along Maggie Creek in an area referred to as the Maggie Creek Canyon.

Areas Susceptible to Future Sinkhole Development

Available information on the geology in the region and prediction of mine-induced ground water drawdown were used to identify areas potentially susceptible to future sinkhole development. These areas include: (1) various locations within a large area underlain by carbonate rock located between the Betze-Post and Gold Quarry pits; (2) an area northwest of the Betze-Post pit; (3) an area along Maggie Creek located north of the Gold Quarry pit; and (4) an area located west of the Gold Quarry pit. The development of sinkholes can pose a hazard to livestock, humans, wildlife, and facilities (such as buildings, roads, and other structures).

Impacts to the Humboldt River

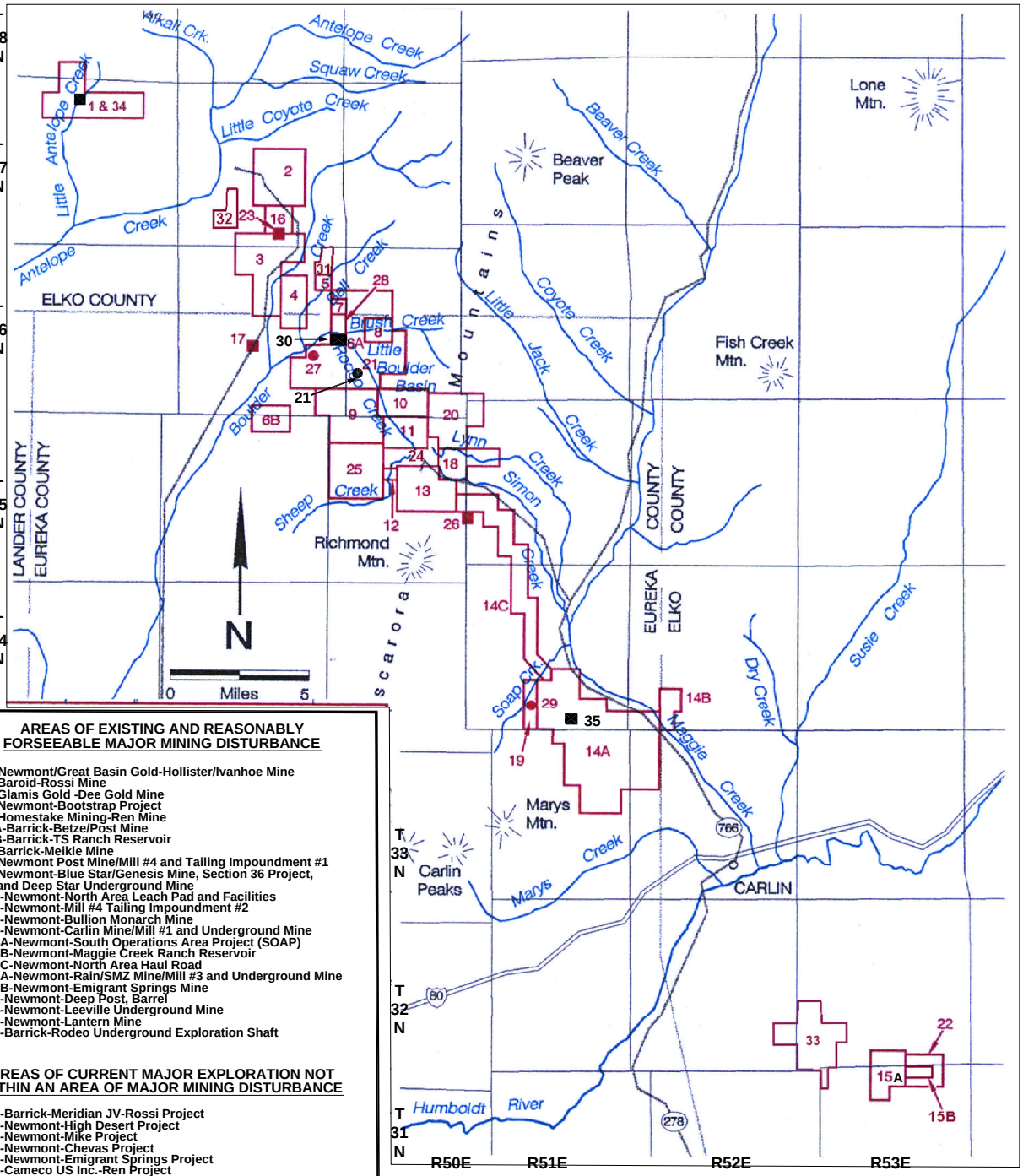
No geological impacts are anticipated to the Humboldt River study area as a result of increased or decreased river flows or dewatering.

Paleontological Resources

Vertebrate fossils occur primarily in Tertiary- and Quaternary-age sediments, whereas invertebrate fossils are more common in Paleozoic-age sedimentary rocks. Because of the greater abundance of vertebrate fossils, open pit mining intercepting Tertiary-age sediments would have the greatest potential for impacting paleontological resources. Other mining related surface activities are shallow and would primarily affect unconsolidated soil surfaces. As a result, cumulative effects on paleontological resources in the region are not expected to be significant. Mining may also expose fossils that may be used for research to further the knowledge of resources in the area.

Air Resources

There may be some regional elevation of particulates through 2011 resulting from short-term construction activities and mining operations. As various mines cease operations, other mines may begin operations over the next few years, so PM_{10} levels would be variable. Mining activities generally produce levels of emissions of carbon monoxide, nitrogen dioxide, sulfur dioxide or ozone that are well below the regulatory allowable levels. **There is potential for cumulative effects from hazardous air pollutants including compounds of arsenic, hydrogen cyanide, manganese, propylene, and acid aerosols. An approximation of mercury emissions to the air from all the mines along the Carlin Trend would be between 2,000 and 3,000 pounds per year, based on TRI information. This estimate is dominated by the processing mills at Newmont's South Operations Area, the Barrick Goldstrike mine, and Newmont's Rain mine. Other large mines without mills would have fugitive emissions only. There is no regulatory requirement for monitoring mercury emissions.** Cumulatively, **these** mining emissions **are** minim**ized to some degree** because of project separation distances, meteorological conditions that promote good dispersion, and the fact that not all projects would produce emissions concurrently. With cessation of mining and completion of reclamation activities, air quality would be expected to return to pre-mining conditions.



AREAS OF EXISTING AND REASONABLY FORSEEABLE MAJOR MINING DISTURBANCE

1-Newmont/Great Basin Gold-Hollister/Ivanhoe Mine
2-Baroid-Rossi Mine
3-Glamis Gold -Dee Gold Mine
4-Newmont-Bootstrap Project
5-Homestake Mining-Ren Mine
6A-Barrick-Betze/Post Mine
6B-Barrick-TS Ranch Reservoir
7-Barrick-Meikle Mine
8-Newmont Post Mine/Mill #4 and Tailing Impoundment #1
9-Newmont-Blue Star/Genesis Mine, Section 36 Project, and Deep Star Underground Mine
10-Newmont-North Area Leach Pad and Facilities
11-Newmont-Mill #4 Tailing Impoundment #2
12-Newmont-Bullion Monarch Mine
13-Newmont-Carlin Mine/Mill #1 and Underground Mine
14A-Newmont-South Operations Area Project (SOAP)
14B-Newmont-Maggie Creek Ranch Reservoir
14C-Newmont-North Area Haul Road
15A-Newmont-Rain/SMZ Mine/Mill #3 and Underground Mine
15B-Newmont-Emigrant Springs Mine
21-Newmont-Deep Post, Barrel
24-Newmont-Leeville Underground Mine
25-Newmont-Lantern Mine
28-Barrick-Rodeo Underground Exploration Shaft

AREAS OF CURRENT MAJOR EXPLORATION NOT WITHIN AN AREA OF MAJOR MINING DISTURBANCE

16-Barrick-Meridian JV-Rossi Project
18-Newmont-High Desert Project
19-Newmont-Mike Project
20-Newmont-Chevas Project
22-Newmont-Emigrant Springs Project
31-Cameco US Inc.-Ren Project
32-Trio Gold Corp-Rodeo Creek Project
33-Newmont-Woodruff Creek Project
34-Great Basin Gold-Ivanhoe Exploration
3-Barrick-Dee Exploration
21-Barrick-Betze Exploration
23-Barrick-Storm Exploration Decline Project (underground exploration same area as #23)

AREAS OF REASONABLY FORSEEABLE MINE DEVELOPMENTS

17-North Area Bioleach Facility
23-Meridian Gold Rossi (Storm) Deposit
26-Newmont-Pete Deposit
1&34-Great Basin Gold-Ivanhoe Underground Mine
30-Barrick-Goldbug Underground Mine
35-Newmont-Chukar Gulch Deposit

LOCATIONS OF KNOWN UNDEVELOPED GOLD DEPOSITS

21-Newmont-Deep Post, Goldbug, Barrel
27-Barrick-Screamer
29-Newmont-Mike

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 5-1
MINING ACTIVITY IN THE CARLIN TREND

MINE AREA: SOUTH AREA	
DATE: 4/1/00	ACAD FILE: Fig5-1.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

TABLE 5-1
EXISTING AND REASONABLY FORESEEABLE MINING DISTURBANCE IN THE CARLIN TREND

Map Reference Number	Facility Name	Existing[1] and Reasonably Foreseeable Mining Disturbance (Acres)				Comments and Source of Acreage Information
		Pre-1981	1981-1999	1999-2016	Total	
1	Newmont/Great Basin Gold - Hollister/Ivanhoe Mine	0	268	0	268	Mine currently undergoing closure and reclamation. Plan of Operations N16-87-002P/Ivanhoe underground is foreseeable action
2	Baroid - Rossi Mine	100	183	280	563	Active barite mine, currently under exploration for gold. (POO N16-81-003P) Expansion of the Mine is a foreseeable action
3	Glamis Gold Ltd. - Dee Gold Mine	0	802	830	1,632	Active gold mine (POO-N16-83-005P)
4	Newmont - Bootstrap Project	234	0	1,118	1,352	Active gold mine (POO N16-94-002P) Bootstrap EIS (BLM, 1996)
5	Homestake Mining Co. - Ren Mine	0	62	0	62	Inactive gold mine and heap leach facility; closure and reclamation in progress. (POO-N16-88-005P)
6A	Barrick - Betze/Post Mine	0	6,758	2,615	9,373	Active gold mine with dewatering (POO-N16-88-002P)
6B	Barrick - TS Ranch Reservoir	0	494	0	494	Catchment reservoir for water discharge from Betze/Post Mine (POO-N16-88-002P)
7	Barrick - Meikle Mine	0	92	0	92	Underground gold mine with dewatering. (POO-N16-92-002P)
8	Newmont - Post/Mill #4 and Tailing Impoundment #1	0	884	0	884	Existing mill and tailing facility. (POO N16-88-008P)
9	Newmont - Blue Star/Genesis Mine, Section 36 Project and Deep Star underground mine	200	1,290	1,022	2,512	Active gold mines. (POO N16-88-007P)
10	Newmont - North Area Leach Facility	0	494	169	663	Existing leach pad facility (POO N16-88-007P)
11	Newmont - Mill #4 Tailing Impoundment #2	0	280	15	295	Existing tailing facility(POO N16-88-008P)
12	Newmont - Bullion Monarch Mine (formerly Universal Gas)	50	0	0	50	Inactive mine, mill and tailing facility; closure and reclamation in progress. (Notice N16-81-013N)
13	Newmont - Carlin Mine/ Mill #1 and Underground Mine	0	1,598	0	1,598	Active gold mine. Expansion (Pete project) permitting in progress (POO N16-81-010P)
14A	Newmont - South Operations Area Project	0	7,960	1,320	9,280	Active gold mine: Expansion permitting in Progress (POO N16-81-009P)
14B	Maggie Creek Ranch Reservoir	0	300	0	300	Catchment reservoir for discharge water from Gold Quarry Mine (POO N16-81-009P)
14C	North Area Haul Road	0	189	0	189	Haulroad between Gold Quarry and Carlin Mines (POO N16-81-009P)

TABLE 5-1 (continued)
EXISTING AND REASONABLY FORESEEABLE MINING DISTURBANCE IN THE CARLIN TREND

Map Reference Number	Facility Name	Existing[1] and Reasonably Foreseeable Mining Disturbance (Acres)				Comments and Source of Acreage Information
		Pre-1981	1981-1999	1999-2016	Total	
15A	Newmont - Rain and SMZ Mine/Mill #3 and Underground Mine	0	954	7	961	Active gold mine (POO N16-86-007P) Expansion Permitting in Progress (Emigrant Springs)
15B	Newmont - Emigrant Springs Mine Project	0	0	418[2]	418	Proposed open pit gold mine; permitting in progress: Expansion of Rain Mine Project (POO N16-86-007P)
17	North Area Bioleach Facility	0	0	600[2]	6,002	Foreseeable gold leach facility and operation. (Newmont)
24	Newmont - Leeville Mine	0	0	4,962	4,962	Proposed underground mine and facilities (POO N16-97-004P)
25	Newmont - Lantern Mine	0	235	3,942	629	Open pit gold mine and foreseeable expansion. (POO N16-88-007P)
26	Newmont - Pete Project	0	0	1,666[2]	1,666[2]	Proposed open pit gold mine and leach operation. Expansion of Carlin Mine (POO N16-81-010P)
34	Great Basin Gold - Ivanhoe Underground Mine	0	0	100[2]	100[2]	Foreseeable underground gold mine and facilities (Stadelman)
35	**Newmont-Chukar Footwall**	**0**	**0**	**0**	**0**	**Forseeable underground gold mine**
TOTAL DISTURBANCE ACRES		584	22,893	11,050	34,477	

Note: Exploration projects are shown in **Figure 5-1** that total 1,397 acres; Newmont Chevas (POO N16-93-002P) = 168 acres; Newmont Mike (POO N16-92-004P) = 48 acres; Newmont High Desert (POO N16-92-003P) = 164 acres; Newmont Emigrant Springs (POO N16-93-001P) = 63 acres; Barrick-Meridian JV Rossi (POO N16-90-002P) = 51 acres; Newmont Woodruf Creek (POO N16-96-002P) = 66 acres; Cameo (US) Ren (POO N16-97-003P) = 30 acres; Trio Gold Rodeo Creek (POO N16-97-002P) = 42 acres; Newmont Carlin (POO N16-81-002P) = 255 acres; Great Basin Gold Ivanhoe (POO N16-93-003P) = 15 acres; Barrick Dee (POO N16-98-001P) = 19 acres; Barrick Goldstrike (POO N16-98-002P) = 233 acres; Barrick Storm Decline (POO N16-99-001P) = 10 acres; Barrick Rodeo/Goldbug Underground Shaft (private land) = 50 acres; Barrick-Betze Exploration (N16-98-002P) = 213 acres.

[1] Projects permitted by BLM as of 2/4/00. **"Disturbed" includes all areas used for mining, processing, and ancillary facilities (roads, ponds, berms, buildings, utilities, etc.)**.

[2] Acreages for reasonably foreseeable disturbances (1999-2011) are estimates subject to change upon submittal of the actual proposal.

POO = Plan of Operations

TABLE 5-2
EXISTING AND REASONABLY FORESEEABLE MINING DISTURBANCE IN THE CARLIN TREND FROM OPEN-PITS ONLY

Map Reference Number	Facility Name	Existing[1] and Reasonably Foreseeable Mining Disturbance for Open-Pits Only (Acres)				Comments and Source of Acreage Information
		Pre-1981	1981-1999	1999-2011	Total	
1	Newmont Great Basin Gold - Hollister Mine	0	54	0	54	Open pit gold mine currently undergoing closure and reclamation (POO N16-87-002P)
2	Baroid - Rossi Mine	0	80	1,002	180	Active open pit barite mine, currently under exploration for gold (POO N16-81-003P) Expansion of the pit is a foreseeable future action
3	Glamis Gold - Dee Gold Mine	0	136	248	384	Active gold mine (POO N16-83-005P)
4	Newmont - Bootstrap Project	59	0	217	276	Active gold mine (POO N16-94-002P)
5	Homestake Mining Co. - Ren Mine	0	5	0	5	Inactive open pit mine and heap leach facility; closure and reclamation in progress. (POO N16-88-005P)
6A	Barrick - Betze/Post Mine	0	1,412	0	1,412	Active open pit gold mine with dewatering (POO N16-88-002P)
9	Newmont - Blue Star/Genesis Mine and Section 36 Project and underground mine	50	506	420	976	Active open-pit and underground (adit) gold mines (POO N16-88-007P)
12	Newmont - Bullion Monarch Mine (formerly Universal Gas)	6	0	0	6	Inactive open pit gold mine, mill and tailing facility; closure and reclamation in progress (Notice N16-81-013N)
13	Newmont - Carlin Mine/Mill #1 and underground mine	100	226	0	326	Active open pit and underground (adit) gold mines (POO N16-81-010P). Expansion (Pete Project) permitting in progress
14A	Newmont - South Operations Area Project (SOAP)	0	**1,019**	**139**	**1,158**	Active open pit gold mine (POO N16-81-009P)
15A	Newmont - Rain, SMZ, and Underground Mines	0	165	7	172	Active open pit and underground (adit) gold mines (POO N16-86-007P), expansion (Emigrant Springs Project) permitting in progress
15B	Newmont - Emigrant Springs Mine	0	0	123	123	Proposed open pit gold mining operation. Permitting in progress; expansion at Rain Mine Project (POO N16-87-006P)
25	Newmont - Lantern Mine	0	53	472	100	Active open pit gold mine and foreseeable mine expansion. (Newmont)
26	Newmont - Pete Mine	0	0	487	487	Proposed open pit gold mine; permitting in progress; expansion at Carlin Mine (POO N16-81-010P)
TOTAL DISTURBANCE ACRES FROM OPEN PITS ONLY/		215	**3,656**	**1,788**	**5,659**	

[1] Projects permitted by BLM as of 2/4/00.

[2] Acreages for reasonably foreseeable disturbances (1999-2017) are estimates subject to change upon submittal of the actual proposal.

POO = Plan of Operations.

Water Resources and Geochemistry

Based on past and planned future dewatering activities, and the ground water modeling conducted for the Goldstrike, Gold Quarry, and proposed Leeville mines, these operations would have cumulative ground water and surface water impacts associated with ground water drawdown and mounding. Four mining operations have been identified with the potential for cumulative impacts associated with discharges to the Humboldt River; these include the Goldstrike Mine, Gold Quarry Mine, Lone Tree Mine, and the proposed Leeville Mine.

Impacts from Mine Dewatering and Localized Water Management Activities

Impacts to Date

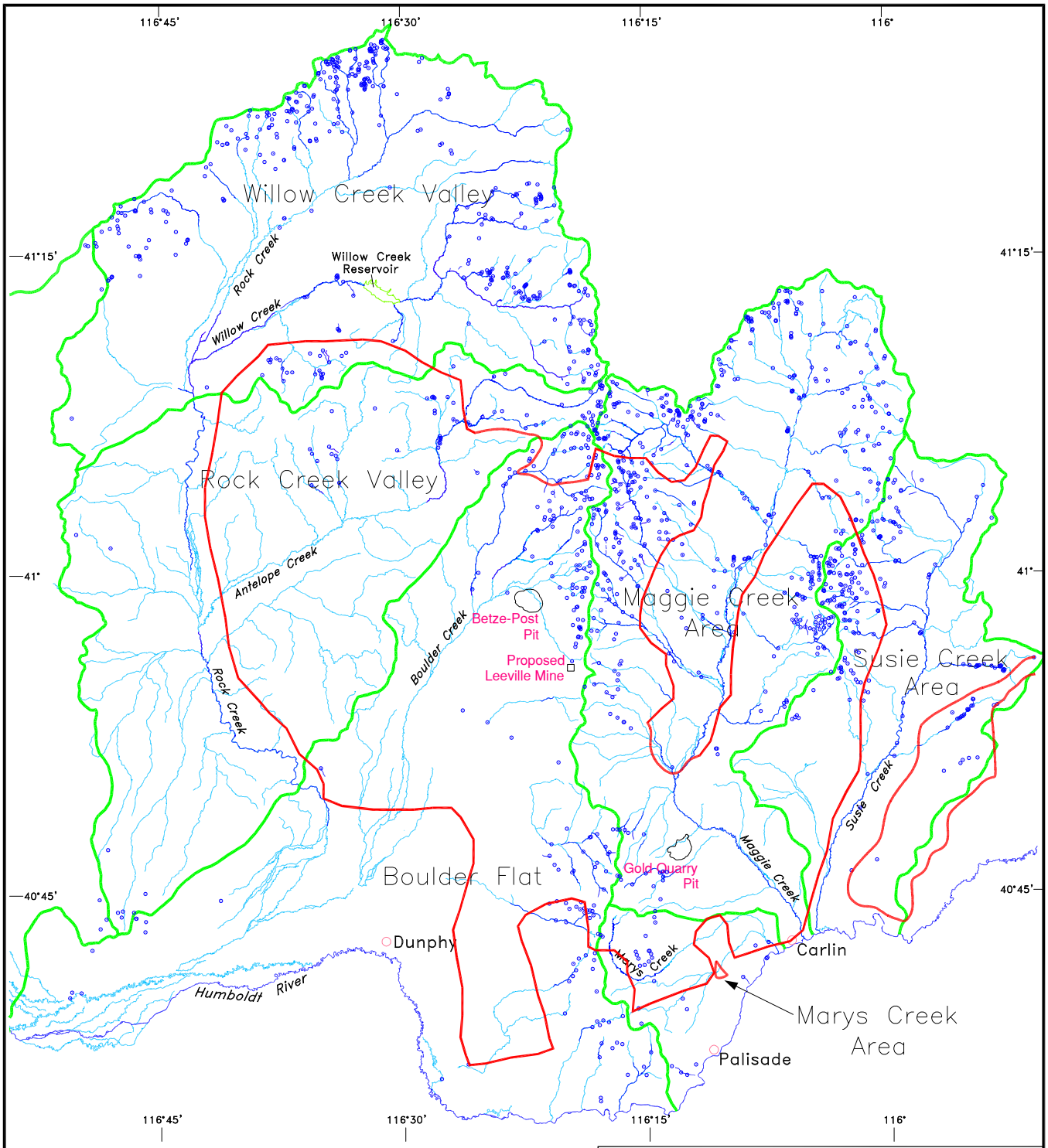
As of the end of 1998, over 1,500 feet of drawdown had occurred to date in the vicinity of the Goldstrike Mine, and over 600 feet of drawdown had occurred in the vicinity of the Gold Quarry Mine as a result of mine dewatering. In the vicinity of the proposed Leeville Mine, 350 feet of drawdown had occurred from existing dewatering operations at other mines. Groundwater cones of depression have formed around the Goldstrike and Gold Quarry mines; both cones of depression exhibit a northwest-southeast elongation and apparently merge together beneath the Tuscarora Mountains southeast of the Carlin Mine.

Infiltration of excess mine water from the dewatering operations has resulted in an increase in water levels, or mounding, in the upper Boulder Valley and lower Maggie Creek areas. As of the end of 1998, water levels in the Boulder Valley region had risen up to approximately 70 feet in the rhyolite in the Sheep Creek Range and 50 feet in the alluvium in upper Boulder Valley. Seepage from Maggie Creek Reservoir and through infiltration along portions of lower Maggie Creek has resulted in an increase in water levels up to 45 feet in the shallow Carlin Formation aquifer.

Near the Goldstrike Mine, several springs located both within and outside of the current 10-foot drawdown area have dried up or shown a reduction in flow, and some of these effects may be related to mine dewatering **(BLM, 2000b)**. The flow and vegetation in Brush Creek, a tributary to Rodeo Creek, have changed substantially since 1993, indicating that this drainage has been impacted by mine dewatering. No other stream impacts have been identified on the western side of the Tuscarora Mountains. In addition, no significant effects on monitored spring flows have been identified on the eastern side of the Tuscarora Mountains or in the vicinity of the Gold Quarry Mine.

Predicted Impacts to Springs and Seeps and Stream Baseflow

Numerical models were used to predict groundwater drawdown over time resulting from the cumulative mine dewatering (**Figure 5-2**). There are approximately 497 springs and seeps identified within the predicted cumulative 10-foot drawdown area. Hydrogeologic conditions, spring and seep surveys, elevations, and geochemistry for representative springs indicate that 195 of these spring and seeps are located in areas where perennial surface waters would potentially be impacted by drawdown.



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 5-2

PREDICTED MAXIMUM EXTENT OF 10-FOOT DRAWDOWN

MINE AREA: SOUTH AREA	
DATE: 8/21/00	ACAD FILE: Fig5-2.DWG
SCALE: AS NOTED	DRAWN BY: ML

Base flows in some stream reaches would potentially be reduced as a result of the mine-induced drawdown from the Goldstrike, Leeville, and Gold Quarry mine operations. Drawdown could impact flows in lower Maggie Creek, lower Marys Creek (and adjacent areas, including the Carlin Cold Springs, and Carlin Hot Springs), lower Susie Creek, Rock Creek, and Boulder Creek; the actual magnitude and extent of impacts to perennial streams is uncertain.

The results of the modeling indicate that water levels in 147 water supply wells would potentially be lowered by at least 10 feet during the mine life or in the post-mining period as a result of drawdown from the Goldstrike, Leeville, and Gold Quarry mines. Lowering the water levels in these wells would potentially reduce yield, increase pumping cost, or if the water level were lowered below the pump setting or below the bottom of the wells, the well would become unuseable.

Predicted Baseflow Reductions

A potential reduction in the baseflow of perennial springs and streams could affect surface water rights within the drawdown area. There are 44 surface water rights located within the potential drawdown area. Twenty-eight of these water rights are used either for irrigation or stock watering, and 16 are used for domestic, mining and milling, municipal, or other uses. The actual potential for impacts to individual water rights would depend on the site-specific hydrologic conditions that control surface water discharge.

Impacts to the Humboldt River

Mine discharges were initiated in 1992 and increased between 1992 and 1998. The Lone Tree Mine began discharging treated water to the Humboldt River in 1992; the Gold Quarry Mine began discharging to Maggie Creek near Carlin, Nevada, in 1994, and the Goldstrike Mine discharged water to the Humboldt River from September 1997 to February 1999. In addition, the proposed Leeville Mine is anticipated to discharge to the river through the existing Goldstrike Mine water conveyance system beginning in the year 2002. Peak cumulative discharges are projected to occur from 1999 through 2006 and would continue at a substantially lower rate from 2006 through 2012.

Comparison of monthly flows at the gages during the pre-mining discharge period (1946 to 1990) with flows during the current mining discharge period (1991 to 1998) indicate that for all months except January 1997 at Battle Mountain, the range of flows recorded during the current discharge period are within the range of flows recorded historically (1946 to 1990). Flows in January 1997 at Battle Mountain were greater than recorded during the pre-mining discharge period; however, mine discharge for this period represents only 3 percent of the flow.

By comparing streamflows resulting from the Proposed Action with those that occurred between 1946 and 1990, the discussion disregards many past cumulative effects on flows in the river from agricultural diversions and the Bureau of Reclamation's projects in particular. For example, Rye Patch dam was constructed in 1936 and other diversions for agriculture likely occurred by the late 1800s. These activities have had a major effect on the biota of the river.

Modeling of projected future discharges indicates that compared to the average pre-mining conditions, the largest percentage increase in flow would occur in the lower flow months (late summer and fall months) and

relatively minor changes in flow are anticipated during the peak flow months (spring to early summer). Simulation of changes to flow during the low-flow year indicate that there is a large relative change to the average monthly flows for the low-flow late summer and fall months at both the Battle Mountain and Comus gages under the maximum discharge scenario.

In the post-discharge period, residual drawdown from the mine dewatering operations is predicted to reduce baseflow in the Humboldt River. The baseflow reductions are predicted to reach a maximum around 2016 and gradually recover thereafter to near pre-mining levels. A longterm reduction of baseflow (around 1 cfs) could be an impact to biota in the river, especially during dry years. The predicted baseflow reductions are a small percentage of baseflow on an annual basis but represent a larger percentage of the average river flow in the drier months (late summer and fall).

The increased Humboldt River flows would generally not create additional flooding along the river upstream of Rye Patch Reservoir.

The cumulative mine discharges would contribute to the stored volume in Rye Patch Reservoir and may present difficulties during high-flow years in preserving emergency storage and minimizing flooding and structural damages downstream. Effects related to stream erosion, sedimentation, and channel geometry from the cumulative discharges are likely to be small. Significant long-term impacts on surface water rights within the Humboldt River basin are not anticipated.

Mine discharges have generally been within their permit limitations. Provided that all of the mine discharges operate in accordance with their permit limitations, cumulative impacts to water quality in the river are not anticipated. On an average annual basis, the mine discharges represent a major loading increase in TDS, arsenic, boron, fluoride, copper, and zinc compared with pre-mine discharge conditions. The cumulative annual average loads from the mine discharges would likely increase TDS, arsenic, boron, and fluoride loads in the Humboldt Sink over the mine discharge period. Those predicted average annual increases are: total dissolved solids - 15 percent, up to approximately 7.5 million tons; arsenic - 21.6 percent, up to approximately 360 tons; boron - 14.6 percent, up to approximately 8,600 tons; and fluoride - 66 percent, up to approximately 10,800 tons (BLM, 2000b). Depending on concentrations in the Humboldt Sink, parameter solubilities and other physical and biological factors, these increased loads to the sink could potentially result in increased concentrations in the sink wetlands (BLM, 2000b).

Floodplains

Predicted Dewatering Effects

As many as 60 miles of stream channels could be indirectly affected by dewatering by proposed and reasonably foreseeable mining projects. Indirect effects could include reducing baseflow or reducing springs and seeps that contribute to surface flow. There would be differences in 100-year floodplain width both from discharge water being added to normal flow, and conversely in Susie Creek, where reductions in baseflow would only leave the runoff component in a 100-year storm event, making the floodplain width narrower. Wherever dewatering would reduce baseflows, the floodplain vegetation would likely become more upland in nature. If riparian vegetation is lost in lower Susie

Creek, the vegetation that replaces it probably would not be able to withstand large flow events without increased erosion.

Impacts to the Humboldt River

Flow increases in the Humboldt River resulting from mine discharges would be well within the active channel for low and moderate flows, and would be undetectable during high flows. As discussed in Chapter 4, it is expected that mine discharge-induced flow increases would have no detectable effect on the Humboldt River floodplain width.

Soils

Over 34,000 acres of soils are predicted to be disturbed by 2011 (**Table 5-1**), but much of that disturbance would be short-term. After reclamation is complete, approximately 6,474 acres would remain with long-term disturbance (open pits) (**Table 5-2**). Even when soils are replaced and revegetated, there would be a long-term loss of soil productivity. Overall, cumulative effects on the soil resource are anticipated to be moderate (18.7 percent residual disturbance).

Vegetation

The known and reasonably foreseeable projects along the Carlin Trend are expected to disturb over 34,000 acres of vegetation by 2011. Disturbance would include loss or reduction of vigor of vegetation due to groundwater drawdown and loss or reduction of surface water sources. All communities would experience these effects whether native or introduced. Physically disturbed areas would be reclaimed according to various reclamation plans and with various seed mixtures, fertilizers and amendments. Disturbed or stressed native communities that were not physically disturbed would not have the benefits of any such amendments and would be expected to recover naturally as the source of the stress was removed. Direct effects would largely be short-term, and reclamation and revegetation would reclaim all but 6,474 acres. Revegetation success is determined as 100 percent cover compared with undisturbed reference areas.

Noxious Weeds

Noxious weeds are spread by vehicles, livestock, wildlife, wind, and water transport of seeds. Each of the more than 30 proposed or reasonably foreseeable projects would maintains a fleet of its own mining vehicles, plus each project would have employee vehicles traveling to and from the site. This level of vehicular travel would contribute greatly to seed dispersal. The cumulative list of projects would disturb over 34,000 acres and disturbed soils are primary invasion sites for noxious weeds. Disturbed soils are also prone to erosion by water and can further promote seed dispersal. Some projects may offer benefits from the control of noxious weeds by physically removing infestations as part of their site development activities. The potential for invasion and the potential for weed removals cannot be quantified, as current levels of weed infestation are not known for each site, and seed dispersal would be variable from site to site.

Wetlands and Riparian Areas

Predicted Dewatering Effects

Approximately 600 acres (14 percent) of the 4,355 acres of riparian vegetation within the cumulative assessment area occur within the areas where perennial waters could be affected by groundwater drawdown. The remaining

3,755 acres of riparian vegetation within the cumulative assessment area occur outside of these areas and are considered less likely to be affected by groundwater drawdown. Approximately 18 additional acres of wetland vegetation associated with isolated springs and seeps occur within these areas where perennial waters could be affected. Therefore, the amount of wetland and riparian vegetation in these areas could be reduced. **The drawdown from dewatering is not expected to compromise the Maggie Creek Watershed Restoration Project.**

Impacts on the Humboldt River

The increased water levels in the Humboldt River during peak and low baseflows would result in a variety of effects. Riparian/wetland plants would become established in areas where the water table is elevated to the depths needed for riparian/wetland plant establishment. Increases in the extent of riparian vegetation would be most noticeable along segments of the river with gradual banks and low-lying areas located adjacent to the river. Other effects may include the deepening of the river channel and loss of streamside riparian vegetation resulting in increased erosion and destabilization of stream banks.

Impacts to riparian/wetland vegetation from anticipated flow reductions within the Humboldt River could include an unquantifiable, long-term reduction in extent of riparian vegetation along the river. Riparian vegetation would begin to re-establish to premining levels upon the eventual recovery of the river's baseflows. During the period of discharges, the areal extent of wetland vegetation within the Humboldt Sink would increase as a result of higher and more consistent water levels.

Terrestrial Wildlife

Predicted Dewatering Effects

Mine dewatering could reduce the amount and extent of available surface water and associated riparian habitats within portions of the cumulative study area for a number of terrestrial species. Flows from naturally occurring springs and perennial reaches within the Maggie Creek, Susie Creek, Marys Creek, Boulder Creek, and Rock Creek subbasins may be affected in the long term (i.e., 100 to 170 years after mining). Potential reduction or loss of available water and long-term effects to the riparian community would result in a loss of breeding, foraging and cover habitats; increased animal mortalities; a reduction in overall biological diversity; possible genetic isolation; a reduction in the regional carrying capacity for terrestrial wildlife; and possible long-term impacts to population numbers of some species. The recovery of groundwater and surface water sources would be gradual. Incremental habitat loss would affect big game, upland game birds, waterfowl, shorebirds, raptors, songbirds, nongame mammals (e.g., bats), area reptiles, and amphibians. If the reclamation does not reproduce the original habitat, a net loss to the original wildlife resource would be expected. Depending on the post mining land use, it is also possible to provide a net gain to wildlife if the reclamation is conducted properly.

However, potential exposure risks to avian and mammalian wildlife from potentially elevated metals and trace elements may occur. Exposure possibilities of wildlife to additional tailing impoundments and the weak cyanide solutions contained in them may increase. If additional pit lakes are developed, wildlife exposure to elevated concentrations of metals

and trace elements may occur. The temporary disturbance of over 34,000 acres would, inevitable, contain some important wildlife habitat. Reclamation of those disturbed areas would restore a large proportion of those lands to wildlife habitat and use.

Impacts on the Humboldt River

Discharges to the Humboldt River would result in impacts to both resident and migratory wildlife during the mine's discharge period. Overall impacts would include increased water availability for consumption, support of riparian vegetation, and restoration of wetland and marshy habitats along the river corridor, which would provide additional nesting, brooding, foraging, and resting habitat. Increased annual flows may result in more open water during the winter season, consequently improving foraging opportunities. The eventual reduction in the Humboldt River baseflows from cumulative drawdown effects could impact the extent of riparian vegetation along the river. However, this river system has evolved with dynamic water regimes, thereby minimizing the effects to wildlife from reduced baseflows. Past cumulative effects such as dams and agricultural diversions have reduced streamflows significantly over those predicted in this cumulative effects analysis.

Impacts on the Humboldt Sink

Increased flows into the Humboldt Sink would improve breeding, foraging, and resting opportunities for many, but not all resident and migratory wildlife species. Possible exposure risks to avian and mammalian wildlife from metals and other constituents compared with premining conditions would be minimal. However, **exposure risks to the biota are dependent on** the dynamic nature of the Humboldt Sink's water system, influence of upstream water demands, fluctuations in water levels, bioaccumulation factors for some metals, and a number of environmental variables (e.g., wind deposition of salts).

Studies in the CIA (BLM, 2000b) concluded that the Humboldt Sink wetlands areas contain arsenic, boron, mercury, molybdenum, sodium, un-ionized ammonia, selenium, and dissolved solids that exceed biological effects levels or Nevada standards for protection of aquatic life. Causes of contamination were identified as irrigation return drainage, the hydrogeologic setting (high background levels), historic mining activities, and droughts. Representative loadings for chromium, mercury, and selenium could not be calculated because these elements were reported as below the detection level in most of the water quality analyses from both mine discharges and in the Humboldt River.

The CIA concluded that cumulative loads from the mine discharges would potentially increase total dissolved solids and dissolved arsenic, boron, copper, fluoride, and zinc loads to the sink over the mine discharge period (27 years, 1992-2018). Increases would be roughly as follows: total dissolved solids (24 percent), boron (42 percent), fluoride (75 percent), arsenic (33 percent), copper (24 percent), and zinc (34 percent). Depending on concentrations in the sink, parameter solubilities, and other physical and biological factors, increased loads to the sink could possibly result in increased concentrations in the sink wetlands. However, similar to periods prior

to mine discharges, the amount of surface water stored in the sink at any one point and the amount of flow received by the sink wetlands appear to be the primary controlling factors for constituent concentrations in the wetlands.

Aquatic Habitat and Fisheries

Predicted Dewatering Effects

Mine dewatering could reduce water levels or flows in some springs and perennial reaches within the Maggie Creek, Susie Creek, Marys Creek, Boulder Creek, and Rock Creek subbasins. The effect of decreased perennial stream flows on aquatic resources would be a reduction of aquatic habitat that supports Lahontan cutthroat trout and other native fish species, periphyton, and macroinvertebrate communities. Water level reductions in springs would affect periphyton, macroinvertebrates, and native fish species (if present). Habitat reductions would likely result in decreased numbers in these communities. If stream segments that do not normally dry out during low flow seasons become dry as a result of reduced flows, aquatic habitat and associated biota would be eliminated. Drawdown would continue to expand and reach a maximum at approximately 100 years during the post-mining period. Afterward, there would be a gradual recovery of the aquifer and most associated surface waters.

Impacts on the Humboldt River

The effects of flow increases on aquatic communities in the Humboldt River would include a variety of impacts. Discharges to the river would result in the effect of increased habitat for fish, macroinvertebrates, and periphyton. However, the possible reduction of shallow pools and braided channels could affect the development of young fish. Increased flows could also result in fish composition changes, as introduced species would be able to disperse and utilize wider areas of the river and likely compete with native species. The effects of increased flows on water quality conditions could involve an increase in the concentrations of metals and trace elements. It is possible that increased sediment levels may affect aquatic biota in a 15-mile section near the Barrick outfall and Comus gage.

Threatened, Endangered, Candidate, and Sensitive Species

Predicted Dewatering Effects

Mine dewatering could adversely affect habitat within the regional hydrologic study area for the following terrestrial wildlife species: Preble's shrew, seven sensitive bat species, sage grouse, bald eagle, ferruginous hawk, northern goshawk, white-**faced** ibis, and black tern. The potential reduction in perennial flows or water levels in springs could reduce the amount of riparian and wetland habitat, which are used by these species for cover, feeding, breeding, or other biological requirements. Mine dewatering may affect the burrowing owl by loss of free water areas. Reduced flows in portions of the Maggie Creek drainage also could affect willow vegetation, which is used by the Nevada viceroy (butterfly)**.**

The SOAPA would be unlikely to contribute cumulative effects on the white pelican. White pelicans also have a low chance of occurring in the cumulative study area, as they require

large bodies of water with islands for breeding, as well as marshes for foraging.

Mine dewatering also could affect habitat for the Lahontan cutthroat trout. Surface flows could be reduced in **spring-fed** portions of **lower** Little Jack/Jack, Beaver, and Maggie creeks, which **have been documented to support** Lahontan cutthroat trout. **However, the majority of LCT habitat in Little Jack, Coyote, and Beaver creeks would not be affected because their upper reaches are not connected to the regional aquifer.** Flow reductions also were predicted for Susie Creek, which is considered a **potential** recovery site for this species.

The U.S. Fish and Wildlife Service has commented that some of the dewatering impacts to Lahontan cutthroat trout may occur decades or more after mine dewatering ceases (Williams, 1999). **Potential reduction in baseflows in Maggie Creek could impact the metapopulation potential for Lahontan cutthroat trout. The Maggie Creek Watershed Restoration Program has significantly improved stream and riparian habitats since 1993, and further improvement is expected. The program was designed to enhance 1,982 acres of riparian habitat and 82 miles of stream channel in the Maggie Creek basin. In light of the relatively small amount of habitat potentially affected, the demonstrated habitat improvement (the Maggie Creek Watershed Restoration Project includes all the streams containing LCT habitat except Beaver Creek), and the committed mitigation measures, potential effects on LCT habitat are considered unlikely.**

Mine dewatering could adversely affect habitat for the spotted frog, California floater, and springsnails. Flow reductions in the Maggie Creek subbasin and lower Rock Creek could decrease habitat used by California floater. Colombia spotted frog could also be affected in Maggie Creek. Springsnails are present in five springs in the cumulative assessment area that could potentially be affected by dewatering drawdown. If any of the springs are dewatered, the population in that spring would be lost.

Impacts to the Humboldt River

Discharges to the Humboldt River would result in impacts to the same terrestrial species listed above. Increased flows in the Humboldt River could result in increased riparian vegetation, which could be used by these species for cover, feeding, breeding, and other biological requirements. The potential impacts to species occurring in the Humboldt Sink area from chemical constituents of concern are summarized in the terrestrial wildlife resource Section.

Livestock Grazing

Predicted Dewatering Effects

Water drawdown resulting from mine-related dewatering activities may affect various water sources used by livestock including improved springs and pipelines, stock wells, springs, seeps, and perennial stream reaches. Impacts may include reduced flow or complete cessation of flow in springs and other water sources. Grazing allotments that could be affected by the potential loss of water sources include the Twenty-five, T-Lazy S, Hadley, Carlin Field, McKinley and Marys Mountain allotments. The potential loss of improved springs and the minor reduction of baseflow in perennial stream reaches would not likely

result in the loss of animal unit months within the Carlin Field, Carlin Canyon, Blue Basin, Lone Mountain, Adobe, Adobe Hills, Palisade, or Horseshoe allotments.

The majority of water-related range improvements and perennial waters located in the T Lazy S allotment could be affected by ground water drawdown. Three stock wells and eight improved springs that supply water to two water pipelines and four stockwater ponds in the central portion of the allotment could be affected. The 1993 Mitigation Plan has specific commitments to supplement or augment spring flows if they are affected by dewatering. Segments of Bell, Welches, Marys, James, Simon, Jack, and Coyote creeks could experience reduced flows. The potential loss of these water sources would reduce the number of animal unit months in the allotment.

Drawdown could affect three improved springs and one natural spring in the Marys Mountain allotment. Perennial reaches of Marys and James creeks, lower Maggie Creek and natural springs within each watershed also could be affected. The potential loss of water sources and amount of available water would likely result in the long-term loss of animal unit months within the allotment.

Impacts to the Humboldt River

Increased water levels within the Humboldt River floodplain would likely increase the areal extent of herbaceous wetlands and irrigated hay meadows within and adjacent to the floodplain. Forage production and the carrying capacity of these areas also would likely increase. Increased water levels also would increase the availability of water for livestock use. Discharge waters reaching the Humboldt and Carson Sinks would not affect grazing management since livestock grazing is not allowed within these areas.

Recreation

The cumulative effects on recreation along the Carlin Trend are twofold: one, in the short-term, the projects would remove over 34,000 acres from public lands available for recreation. Two, mining projects have the potential to alter access to and the physical and visual setting of an area over the long-term, with resulting impacts on persons pursuing recreation in the area. After 2011, and after reclamation of the various projects are complete, much of the area would again be available for recreation. However, open pits and steep sloped areas may comprise several thousand acres that would not be suitable for recreation over the long-term.

However, there are no developed recreation sites along the Carlin Trend that would be impacted. There would be no new kinds of pressures placed on recreational facilities in the area, but existing pressures would be extended **over ten years or more from continued mining activities.** Dispersed recreation in the area (primarily hunting and off-road vehicle use) is relatively minor (in part because existing mining operations have fenced and prohibited access to large areas already). In general, the cumulative acreages removed by the mining projects would be considered minor relative to the area available for similar uses in adjacent areas of public lands.

Visual Resources

The primary viewing locations of the Carlin Trend area are from Interstate 80, State

Highway 766 north of Carlin, and State Highway 278 south of Carlin. Views from Interstate 80 would only be affected by Newmont's Gold Quarry Project. Views from State Highway 766 would be affected by several Newmont projects, including the North Area Haul Road, future development at the Pete Deposit, the Carlin Mine, future development at the High Desert project, and future development at the Chevas project. Views from State Highway 278 would possibly be affected by Newmont's Rain/SMZ and Emigrant Springs projects nearly six miles east of the highway. All other projects listed in the cumulative effects area are located on the west side of the Tuscarora Mountains or in the Boulder Creek valley where they are largely outside the viewsheds of major public highways.

Cumulative visual impacts would include major but short-term contrasts between steam or vapor plumes (gray to white) from plants and cooling towers and the brown and tan earth and vegetation colors seen as background to the plumes. Visual impacts from structures would be minor and short-term. The largest magnitude visual effect would result from creation of large angular landforms that would contrast strongly with natural landforms until reclamation, when angularity and color contrast would be reduced by reclamation activities. None of the reasonably foreseen mining activities on the Carlin Trend are expected to compromise the Visual Resource Management objectives for Class III and Class IV lands, and cumulative impacts are expected to be moderate.

Noise

Noise levels would be expected to increase over time, especially if several of the reasonably foreseeable projects were developed concurrently, and especially if the projects were adjacent, even though project noise sources may be miles apart. After mining and reclamation are completed, noise levels would return to near pre-mining levels. No noise sensitive areas or receptors would be adversely affected by cumulative development along the Carlin Trend.

Land Use and Access

The known and reasonably foreseeable activities would disturb approximately 34,000 acres by 2011. During active operations, public access is prohibited for safety reasons. Following mining and reclamation, access and pre-mining land uses would be restored. Restored access to the areas may be altered as a result of the new landforms created. A portion of the sites (open pits, steep slopes) would not be returned to their pre-mining land use, and these could comprise from 4,800 to 9,600 acres (15 to 30 percent disturbance area). Pre-mining uses of groundwater and surface water could be affected within the area of the 10-foot drawdown contour for the long-term.

Cultural Resources

Known and reasonably foreseeable actions in the Gold Quarry area could bring about increased disturbance beyond that proposed in this EIS. Future disturbance could adversely effect eligible cultural resources in the Gold Quarry area. However, any future proposed disturbance to significant cultural resources would be offset by mitigation measures approved by the BLM after consultation with the Western Shoshone and the Nevada SHPO. Thus, there are no cumulative adverse effects

to cultural resources expected as a result of the Proposed Action.

Native American Religious Concerns

The assessment of Native American concerns was based on two types of information. Initially, emphasis was placed on the review of existing literature. Sources reviewed included ethnographic reports and monographs that address the region and manuscripts and material on file with the BLM. The various bands of the Te-Moak Tribe of Western Shoshone, the Duck Valley Tribal Council, the Shoshone-Bannock Tribe, the Western Shoshone Defense Project, and the Western Shoshone Historic Preservation Society were contacted by the BLM.

Information derived from these sources indicate that ground water drawdown could have an effect on resources of specific concern to Native Americans. Water is central to all living and spiritual things. The Western Shoshone feel that predicted impacts to stream flows, springs, and seeps would have a particularly adverse effect. Impacts **c**ould occur to riparian communities and animals that depend on those communities. The Western Shoshone are very concerned with the direct impacts that **c**ould occur to water, plants, and animals, especially sage grouse. Of even greater concern to the Western Shoshone are the disruptions that could occur to life and spirit forces found in or associated with these waters, plants, and animals. Impacts **c**ould occur to two areas identified by BLM as traditional cultural properties. Impacts to those areas **c**ould affect the ability of the Western Shoshone to maintain cultural traditions.

In summary, the Western Shoshone believe that ground water drawdown would have an adverse impact on both the physical and spiritual worlds. Impacts of the magnitude proposed are dangerous in that they would substantially alter the intricate web of power relationships that exist in nature and between the Western Shoshone and Mother Earth. Details of these findings can be found in the Cumulative Impacts Analysis for Mine Dewatering, a separate technical analysis completed in conjunction with the SOAPA EIS (BLM, 2000b).

Social and Economic Resources

Predicted Dewatering Effects

A total of 147 water supply wells that have current permits or certificate status with respect to water rights issued by the State Engineer (excluding wells owned or affiliated with Barrick or Newmont) would be affected by drawdown. A majority of the 147 wells are for purposes of stock watering (26 percent), mining/milling (14 percent), and irrigation (44 percent).

Springs with reduced flow may affect some water sources for livestock and wildlife, resulting in socioeconomic impacts to affected livestock owners and the state's wildlife resources. Springs that support domestic water supply to the town of Carlin (i.e., Carlin Cold Springs in the Marys Creek drainage) could also be affected by dewatering in the Carlin Trend.

A total of 44 surface water rights have been identified within the potential cumulative ground water drawdown area; 28 of these water rights are for irrigation or livestock

watering. Therefore, socioeconomic impacts probably would occur from reduced streamflow for these designated uses.

Impacts to the Humboldt River

Since the Humboldt River is over-appropriated, the additional excess mine water would be a positive effect to water right holders in the basin. Potential effects from increased flow in the Humboldt River could include limited additional flooding during periods of high flow. The additional inundated area would likely be limited to the immediate vicinity of the river and generally would involve lower elevation hayfields and meadows, therefore, no major socioeconomic impacts would be expected. If additional mine discharge water during high-flow periods contributes to approaching the capacity of Rye Patch Reservoir, damage could occur to the conveyance canals and gates and cause flooding of agricultural fields downstream from the reservoir.

Based on general irrigation flow data, approximately 30,000 to 60,000 ac-ft/yr of mine discharge may reach the Humboldt and Carson Sinks if not consumed upstream by irrigation practices. As a result, greater water depths and areas of inundation could occur in the sinks from the additional water. This could have an effect on water availability for wildlife and possibly create an effect on agricultural drainage conditions upstream of the Humboldt Sink if the additional flow is excessive. These effects would have a duration approximately equal to the projected life of the combined mine discharges.

Increased water in the Humboldt River may limit the ability to repair irrigation diversion structures during the low-flow periods. Irrigators typically repair these structures as needed when river flow has declined in the fall. The increased flow from mine discharges may cause more water to be in contact with the irrigation structures on a year-round basis and make it more difficult to perform the necessary repairs.

The predicted long-term decrease in Humboldt River flow would range from about 9 to 14 percent and could extend for a period of more than 100 years. The ability for some agricultural operations to irrigate late season hay or to water livestock may be limited by decreases in flow. Specific irrigators with more junior water rights may have reduced access to water. Newmont, owner of the T Lazy S Ranch, will reduce its rate of diversions to compensate for any baseflow reductions in the Humboldt River as part of the SOAP Mitigation Plan.

Wastes - Solid or Hazardous

Volumes of solid waste generated are highly variable from large operators, such as a surface mine, to an underground mine, to an exploration drilling project that would generate the least amount of solid waste. Currently, non-hazardous solid wastes can be disposed of in one of two ways: (1) an operator can request a permit for an on-site Class III landfill waiver, construct the landfill and dispose of wastes on-site, or (2) the operator can transport the waste to existing county landfills in Elko or Eureka counties. In light of the over 30 known or reasonably foreseeable projects, Elko and Eureka counties would experience either a great increase in permit applications for on-site landfills, or the counties would experience significant increases in solid wastes being hauled to the county landfills.

Hazardous wastes are subject to stringent permitting requirements. Currently, Newmont and Barrick are the largest among only a

handful of operators classified as hazardous waste generators. All hazardous wastes must be handled according to approved permits or be disposed of according to state or federal regulations. The known and reasonably foreseeable project would cumulatively result in larger volumes of hazardous wastes stored on site, transported on state and federal highways, and disposed of in approved disposal sites. The volumes of hazardous wastes cannot be quantified until future hazardous waste generators are identified.

The frequency of transportation spills is not expected to change significantly because active projects may close down as new projects come on-line. The frequency of on-site spills is also expected to remain similar to current rates for the same reason. All mines are mandated to have Spill Prevention, Control, and Countermeasure Plans in place as part of their state/federal discharge permits to mitigate the effects of spills.

Environmental Justice

No cumulative effects on environmental justice are expected because the known and reasonably foreseeable projects are all located in an area remote from population centers, an area already affected by mining operations, and by an industry that has already demonstrated that it hires employees from all communities and socioeconomic levels.

CHAPTER 6
CONSULTATION, COORDINATION, AND PREPARATION

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CONSULTATION, COORDINATION, AND PREPARATION

PUBLIC PARTICIPATION SUMMARY

This Public Participation Summary is specific to the proposal presented in Newmont's Plan of Operations for the SOAPA. The summary indicates means of public involvement, identifies persons and organizations to be contacted for comments and feedback, and specifies time frames for accomplishing goals in accordance with 40 CFR 1506.6.

This summary includes the necessary steps for public involvement in the EIS process to identify and deal with public concerns and needs. This process assists in: (1) broadening the information base for decision making; (2) informing the public of the proposal and long-term impacts resulting from the action; and (3) ensuring that public needs and desires are understood by BLM.

Public notice and opportunity for participation are required at four specific points in the EIS process: the scoping period, review of the Draft EIS, review of the Final EIS, and receipt of the Record of Decision.

- The 30-day scoping period provided the public the opportunity to identify potential issues associated with the Proposed Action that might warrant analysis during development of the Draft EIS.

- The 60-day review of the Draft EIS is initiated by publication of a Notice of Availability for the Draft EIS in the Federal Register. During the review period, public hearings may be held in Elko to obtain comments.

- The 30-day review of the Final EIS is initiated by publication of a Notice of Availability for the Final EIS in the Federal Register.

- Subsequent to the 30-day review of the Final EIS, the Record of Decision will be prepared and a Notice of Availability for the Record of Decision will be published in the Federal Register.

IMPLEMENTATION

1. The scoping period was initiated by publication of a Notice of Intent on June 19, 1997. The Notice of Intent summarized the Proposed Action and BLM's determination that an EIS was necessary for analysis of the proposal. Appropriate news media and the public were notified of the periods available for comment through publication of the scoping process in the Elko Daily Free Press. Information was sent to the following list of media outlets:

Deseret News Salt Lake City, UT	The Statesman Boise, ID
Eureka Sentinel Tonopah, NV	Salt Lake Tribune Salt Lake City, UT
Las Vegas Sun Las Vegas, NV	Las Vegas Review Las Vegas, NV
Humboldt Sun Winnemucca, NV	Ely Daily News Ely, NV
Reno Gazette Journal Reno, NV	Associated Press Reno, NV

High Desert Advocate Wendover, NV	United Press International Carson City, NV
Numa News Fallon, NV	North American Mining Reno, NV
KRJC Radio Elko, NV	Elko Daily Free Press Elko, NV
KENV TV Elko, NV	KELK Broadcasting Co. Elko, NV
Karen Terrell	Independent News Contractor Times News, Elko, NV

Written notification and briefing of the scoping period were also given to the Elko and Eureka County Commissioners.

A formal public scoping meeting was held in Elko, Nevada, on July 9, 1997. In addition to the officials and agencies identified above, 214 scoping letters were sent to various agencies, groups, and individuals. Each of the 13 individuals who attended the scoping meeting held in Elko also received a copy of the scoping letter.

Scoping comments were accepted until July 18, 1997. During that period a total of six written responses were received from individuals and groups. This includes comments received from the Nevada State Clearinghouse. A Public Scoping Report was developed by BLM in August 1997 that summarized the scoping process and comments.

2. An EIS mailing list of interested persons was assembled from previous mining-related EIS mailing lists and from names of participants who attended the scoping meeting. This list will be continuously updated as needed throughout the EIS process.

3. Distribution of the Draft EIS will occur as follows:

   - A Notice of Availability will be published in the Federal Register specifying the dates for the comment period and the dates, times, and locations of public hearings.

   - In conjunction with the 60-day comment period on the Draft EIS, a news release will be developed and submitted to relevant news outlets through the Elko Field Office of the BLM.

   - The Draft EIS will be distributed to interested parties identified on the updated EIS mailing list.

   - Public meetings may be held in Elko to obtain comments on the Draft EIS approximately 30 to 45 days after publication of the Federal Register Notice.

4. The Final EIS will be completed considering comments from the review of the Draft EIS and released as follows:

   - A Notice of Availability will be published in the Federal Register.

   - Copies of the final document will be sent to all those on the updated mailing list.

- A news release will be issued to relevant news outlets through the Elko Field Office of the BLM.

5. The Record of Decision will be distributed to people and organizations on the updated mailing list, and a Notice of Availability will be published in the Federal Register. Briefings will be offered to the Nevada Clearinghouse and conducted, as required. A news release will be issued to relevant news outlets to announce distribution of the Record of Decision.

CRITERIA AND METHODS BY WHICH PUBLIC INPUT IS EVALUATED

Substantive comments from letters and testimony concerning the Draft EIS will be reviewed and evaluated by BLM to determine if information is presented that requires a formal response or contains new data to be brought to the attention of the BLM which identifies deficiencies in the Draft EIS. Steps would then be initiated to correct such deficiencies and to incorporate the information into the Final EIS.

CONSULTATION WITH OTHERS

The following local, state and federal agencies were consulted during preparation of this EIS:

- Eureka County
- Elko County
- Nevada Division of Wildlife
- Nevada Department of Conservation and Natural Resources
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency Region IX
- U.S. Fish and Wildlife Service

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Honorable John Ensign, Carson City, NV
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Honorable Harry Reid, United States Senate, Carson City, NV
Honorable Kenny C. Guinn, Governor of the State of Nevada, Carson City, NV
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Bureau of Land Management (USDI), Field Manager, Las Vegas, NV
Bureau of Reclamation (USDI), Environmental Office, Denver, CO
Bureau of Reclamation (USDI), Brenda Whittington, Washington, DC
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Wells Chamber of Commerce, Wells, NV
Lander County Commission, Battle Mountain, NV
Eureka County Public Land Advisory Commission, Eureka, NV
Eureka County Commissioners, Eureka, NV
Public Land Use Planning Commission, Elko, NV
ECEDA, Elko, NV
Elko Chamber of Commerce, Elko, NV
Elko County School District, Elko, NV
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City Mayor, Elko, NV
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City of Wells, Wells, NV
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Ron Espell, Barrick Goldstrike, Elko, NV
Jim Collard, Cortez Gold Mines, Crescent Valley, NV
Karen Gross, Royal Gold, Denver, CO
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Bob Ingersoll, Salt Lake City, UT
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Minex Resources Inc., Riverton, WY
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Nevada Woolgrowers Asson, Eureka, NV
Hooper, Wolf & Garrett Families, Elko, NV
TS Joint Venture, Battle Mountain, NV
Maggie Creek Ranch, Elko, NV
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CHAPTER 7
REFERENCES, GLOSSARY, LIST OF ABBREVIATIONS, AND INDEX

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REFERENCES, GLOSSARY, LIST OF ABBREVIATIONS, AND INDEX

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GLOSSARY

Acid Rock Drainage - Drainage with a pH of 2.0 to 4.5 from mines and mine wastes that is the result of oxidation of sulfides exposed during mining.

Acre-feet - The volume of liquid or solid required to cover one acre to a depth of one foot, or 43,560 cubic feet; measure for volumes of water, reservoir rock, etc.

Allotment - A unit of land suitable and available for livestock grazing that is managed as one grazing unit.

Alluvium - Unconsolidated or poorly consolidated gravel sands and clays, deposited by streams and rivers on riverbeds, floodplains, and alluvial fans.

Ambient - The environment as it exists at the point of measurement and against which changes or impacts are measured.

Angle of Repose - The maximum angle of slope at which loose, cohesionless material remains stable. It commonly ranges between 33^{o} and 37^{o} on natural slopes.

Animal Month - For a cow/calf operations, it is the amount of forage consumed by a 1,000 pound cow and calf (less than 6 months of age) over a one month period. It is approximately 1,050 pounds of forage.

Animal Unit Months (AUMs) - For the BLM allotments, it is the amount of forage consumed by a 1,000 pound cow over a one month period, approximately 800 pounds of forage. An animal unit month is then multiplied by 1.32 for a cow/calf operation such as the Mahala Creek allotment, and is equivalent to an animal month for purposes of this document.

Anomaly - A geological feature, especially in the subsurface, distinguished by geological, geophysical, or geochemical means, which is different from the general surroundings.

Aquatic Resources - Biological resources (plants, animals, and other life forms) present in or dependent on streams, lakes, and other surface water.

Aquifer - A body of rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.

Aspect - The direction toward which a slope faces with respect to the compass or the sun.

Assemblage - A group of rocks grouped together by age or similar origin.

Asymtote - Asymtotically - A straight line associated with a curve such that as a point moves along an infinite branch of the curve the distance from the point to the line approaches zero.

Background - The viewing area of a distance zone that lies beyond the foreground-middleground. Usually from a minimum of 3 to 5 miles to a maximum of about 15 miles from a travel route, use area, or other observer position. Atmospheric conditions in some areas may limit the maximum to about 8 miles or increase it beyond 15 miles.

Baseline Study - A study conducted to gather data prior to mining for the purpose of outlining conditions existing on an undisturbed site. Impacts are evaluated against the baseline data and reclamation success is measured against baseline data.

Bioaccumulation - A process by which chemicals are taken up by organisms from water or sediment directly or through consumption of food containing the chemicals.

Biodiversity - The diversity of species, ecosystems, and natural processes in an area.

Broadcast seeding - Distribution of seed by a fan spreader or by hand spreading.

CFR - Code of Federal Regulations, the compilation of federal regulations adopted by federal agencies through a rule-making process.

Characteristic Landscape - The established landscape within an area being viewed. The term does not necessarily mean a naturalistic character, but may refer to features of the cultural landscape, such as a farming community, an urban landscape, or other landscape that has an identifiable character.

Colluvium - General term applied to loose and incoherent deposits, usually at the foot of a slope of cliff and brought there chiefly by gravity; such as talus and cliff debris.

Community Types (vegetation) - A group of plants living in a specific region under relatively similar conditions.

Contrast - The effect of a striking difference in the form, line, color, or texture of the landscape features within the area being viewed.

Cultural Resources - The archaeological and historical remains of human occupation or use. Includes any manufactured objects, such as tools or buildings. May also include objects, sites, or geological/geographical locations significant to Native Americans.

Cumulative Effects -As defined by 40 CFR 1508.7, cumulative effects are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes

such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

dBA - The sound pressure levels in decibels measured with a frequency weighing network corresponding to the A-scale on a standard sound level meter. The A-scale tends to suppress lower frequencies, e.g., below 1,000 Hz.

Debitage - Chipped stone flaking debris resulting from stone tool making.

Decibel (dB) - A unit used in expressing ratios of electric or acoustic power. The relative loudness of sound.

Direct Effects - As defined by 40 CFR 1508.9, these are effects which are caused by the action and occur at the same time and place as the action. Synonymous with direct impacts.

Discharge - The volume of water flowing past a point per unit time, commonly expressed as cubic feet per second (cfs), gallons per minute (gpm), or million gallons per day (mgd).

Disturbed Area - Area where natural vegetation and soils have been removed or disrupted.

Drainage - Natural channel through which water flows some time of the year. Natural and artificial means for effecting discharge of water as by a system of surface and subsurface passages.

Drawdown - The lowering of the water level in a well as a result of withdrawal.

Earthquake - Sudden movement of the earth's crust resulting from faulting, volcanism, or other mechanisms.

Endangered Species - Any species in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.

Ephemeral Stream - A stream or portion of a stream that flows briefly in direct response to precipitation in the immediate vicinity, and whose channel is at all times above the water table.

Erosion - The wearing away of soil and rock by weathering, mass wasting, and the action of streams, glaciers, waves, wind, and underground water.

Evapotranspiration - The portion of precipitation returned to the air through evaporation and plant transpiration.

Exploration - The search for economic deposits of minerals, ore, and other materials through practices of geology, geochemistry, geophysics, drilling, and/or mapping.

Fault - Surface of rock rupture along which has been differential movement.

Fisheries - Streams and lakes used for fishing.

Floodplain - That portion of a river valley, adjacent to the channel, which is built of sediments deposited during the present regimen of the stream and is covered with water when the river overflows its banks at flood stages.

Footprint - The actual surface area physically disturbed by mining operations and ancillary facilities.

Forage - Vegetation used for food by wildlife, particularly big game wildlife and domestic livestock.

Forb - Any herbaceous plant other than a grass.

Foreground-Middleground - The area visible from a travel route, use area, or other observer position to a distance of 3 to 5 miles. The outer boundary of this zone is defined as the point where the texture and form of individual plants are no longer apparent in the landscape, and vegetation is apparent only in pattern or outline.

Fugitive Dust - Dust particles suspended randomly in the air from road travel, excavation, and rock loading operations.

Game Species - Animals commonly hunted for food or sport.

Geochemistry - The study of the distribution and amounts of the chemical elements in minerals, ores, rocks, soils, water, and the atmosphere, and their circulation in nature, on the basis of the properties of their atoms and ions.

Geotechnical - A branch of engineering concerned with the engineering design aspects of slope stability, settlement, earth pressures, bearing capacity, seepage control, and erosion.

Grade - A slope stated in terms of feet per mile or as feet per feet (percent); the content of precious metals per volume of rock (ounces per ton).

Ground Cover - The amount of ground surface covered by vegetation.

Ground Water - All subsurface water, especially that as distinct from surface water portion in the zone of saturation.

Ground Water Table - The surface between the zone of saturation and the zone of aeration; that surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

Habitat - The place or type of site where a plant or animal naturally or normally lives and grows. Includes all biotic, climatic, and soils conditions, or other environmental influences affecting living conditions.

Haul Road - All roads utilized for transport of an extracted mineral, waste, overburden, or other earthen materials.

Heavy Metals - A group of elements that may be acquired by organisms in trace amounts that are toxic in higher concentrations. Includes copper (Cu), lead (Pb), mercury (Hg), molybdenum (Mo), nickel (Ni), cobalt (Co), chromium (Cr), iron (Fe), silver (Ag), etc.

Herbaceous Perennials - Leafy, non-woody plants with fleshy stems that have a life span of more than two years.

Host Rock - A body of rock serving as a host for mineral deposits.

Hydrology - A science that deals with the properties, distribution, and circulation of surface and subsurface water.

Hydrophytic Vegetation - Plants that grow in and are adapted to an aquatic or very wet environment.

Hydrostatic Head - The height of a vertical column of water, the weight of which, if of unit cross-section, is equal to the hydrostatic pressure at a point.

Igneous - Rock or mineral that solidified form molten or partly molten magma, processes relating to or resulting from the information of such rocks.

Impoundment - The accumulation of any form of water in a reservoir or other storage area.

Indirect Effects - As defined by 40 CFR 1508.8, these are effects which are caused by the action but occur later in time or are removed in distance from the action, but are still reasonably foreseeable. Synonymous with indirect impacts.

Infiltration - The movement of water or some other liquid into the soil or rock through pores or other openings.

Infrastructure - The basic framework or underlying foundation of a community including road networks, electric and gas distribution, water and sanitation services, and facilities.

Intermittent Stream - 1) A stream that flows only at certain times of the year, as when it receives water from springs or from a surface source; and 2) a stream that does not flow continuously, as when water losses from evaporation or seepage exceed the available stream flow.

Irretrievable - Applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.

Irreversible - Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors that are renewable only over long time spans, such as soil productivity and aspen regeneration. Irreversible also includes loss of future options.

Jurisdictional Wetland - A wetland area identified and delineated by specific technical criteria, field indicators, and other information for purposes of public agency jurisdiction. The public agencies which administer jurisdictional wetlands are the US Army Corps of Engineers, US Environmental Protection Agency, US Fish and Wildlife Service, and USDA-Soil Conservation Service.

Land Use - Land uses determined for a given area that establish the types of activities allowed (e.g., mining, agriculture, timber production, residences, industry) and the size of buildings and structures permitted.

Landform - Any physical, recognizable form or feature of the Earth's surface, having a characteristic shape and produced by natural causes. Includes major features such as plains, plateaus, and mountains, and minor features, such as hills, valleys, slopes, canyons, arroyos, and alluvial fans.

Landscape Character - The arrangement of a particular landscape as formed by the variety and intensity of the landscape features as defined as the four basic elements (form, line, color, and texture). These factors give the area a distinctive quality that distinguishes it from its immediate surroundings.

Lifts - Construction of waste rock dumps in a series of layers.

Lithology - The description of rocks in terms of the physical character of a rock, mineral composition, grain size, color and other physical characteristics.

Long-Term Effects - Long-term effects are effects that would remain following completion of the project. As an example, the loss of vegetation from the development of an open pit would be a long-term effect if the pit were not reclaimed and vegetation not re-established at the end of the project. Other long-term effects, as defined in the Cumulative Effects Analysis (CEA), are coarse and durable angle of repose waste rock dump slopes and haul roads.

Maximum Modification - A visual quality objective that allows activities that alter the vegetation and landform to dominate the original characteristic landscape with some limitations.

Mesic - Moist habitats associated with springs, seeps and riparian areas.

Metapopulation - A population comprised of a set of populations linked by migration, allowing for recolonization of unoccupied habitat patches after local extinction events.

Milling - The general process of separating the economic constituents (metals) from the undesired or un-economic constituents of ore material (tailings).

Mineralization - The process by which a valuable mineral or minerals are introduced into a rock.

Mitigate, Mitigation - To cause to become less severe or harmful to reduce impacts. Actions to avoid, minimize, rectify, reduce or eliminate, and compensate for impacts to environmental resources.

Modification - A visual quality objective in which man's activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.

Monitor - To systematically and repeatedly watch, observe or measure environmental conditions in order to track changes.

National Register of Historic Places - A list, maintained by the National Park Service, of areas which have been designated as being of historical significance.

Native Species - Plants that originated in the area in which they are found, i.e., they naturally occur in that area.

NEPA - The National Environmental Policy Act of 1969. It is the national charter for protection of the environment. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Regulations at 40 CFR 1500-1508 implement the act.

Net Proceeds Tax - This is a form of income tax assessed as a property tax intended to assess the value of the minerals which are being extracted.

Noxious Weeds - An alien, introduced or exotic species that is adventive, aggressive, or overly-competitive with more desirable species.

Nutrients - Essential chemicals needed by plants or animals for growth and health. If other physical and chemical conditions are optimal, excessive amounts of nutrients can lead to degradation of water quality by promoting excessive growth, accumulation and subsequent decay of plants, especially algae. Some nutrients can be toxic to animals in high concentrations.

One-hundred year, twenty four-hour storm event (100-year, 24-hour) - the maximum precipitation predicted to occur within any 24-hour period over a period of 100 years.

Ordinary high water mark (OHWM) - line on the shore of a water body or stream established by the fluctuation of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas

Ore - A deposit of rock from which a valuable mineral or minerals can be economically extracted.

Overburden - Material which overlies a deposit of valuable material.

Pit Backfill - Placing waste rock in a mined-out pit.

Partial Retention - A visual quality objective in man's activities may be evident, but must remain subordinate to the characteristic landscape.

Patent - A document conveying title to land from the U. S. Government to private ownership.

Perched Water - Unconfined groundwater separated from the underlying main body of groundwater by unsaturated rock.

Perennial Stream - A stream or reach of a stream that flows throughout the year.

Periphyton - Organisms, both plant and animal, attached or clinging to stems and leaves of rooted plants or other surfaces projecting above the bottom of a water body.

Permeable - The property or capacity of a porous rock, sediment, or soil to transmit a liquid.

pH - The negative $\log_{10}$ of the hydrogen ion activity in solution; a measure of acidity or basicity of a solution. **pH 1 is highly acidic and pH 14 is strongly basic.**

Phenologically - Relating to biological phenomena such as flowering, breeding, and migration, especially in conjunction with variation in climate.

Plan of Operations - As required by 43 CFR 3809, the operator submits a Plan of Operations (POO) to the BLM that includes: the name and address of the operator, location of the proposed area of operations, information sufficient to describe the type of operations proposed, and measures to be taken to meet the requirements for environmental protection.

Peak Flow - The greatest flow attained during melting of winter snowpack or during a large precipitation event.

Precious Metal - A general term for gold, silver or any of the minerals of the platinum group.

Preservation - A visual quality objective that provides for ecological change only.

Productivity - In reference to vegetation, productivity is the measure of live and dead accumulated plant materials.

Project Alternatives - Alternatives to the proposed Project developed through the NEPA process.

Protohistoric - Time period when native culture is in contact with outside culture before written record.

Public Scoping - Scoping is the process for determining the scope of issues and concerns to be addressed and for identifying the significant issues related to a proposed action. (40 CFR 1501.7).

Raptor - A bird of prey (e.g., eagles, hawks, falcons, and owls).

Recontouring - Restoration of the natural topographic contours by reclamation measures, particularly in reference to roads.

Record of Decision (ROD) - A decision document for an Environmental Impact Statement or Supplemental EIS that publicly and officially discloses the responsible official's decision regarding the actions proposed in the Environmental Impact Statement and their implementation.

Reserves - Identified resources of mineral-bearing rock from which the mineral can be extracted profitably with existing technology and under present economic conditions.

Resources (geologic) - Reserves plus all other mineral deposits that may eventually become available - either known deposits that are not recoverable at present, or unknown deposits, that may be inferred to exist but have not yet been discovered.

Retention - A visual quality objective which, generally means man's activities should not be evident to the casual forest visitor.

Riparian - Situated on or pertaining to the bank of a river, stream, or other body of water. Riparian is normally used to refer to plants of all types that grow along streams, rivers, or at spring and seep sites.

Runoff - That part of precipitation that appears in surface streams; Precipitation that is not retained on the site where it falls and is not absorbed by the soil.

Scoping - Procedures by which agencies determine the extent of analysis necessary for a proposed action, (i.e., the range of actions, alternatives, and impacts to be addressed; identification of significant issues related to a proposed action; and the depth of environmental analysis, data, and task assignments needed).

Sediment Load - The amount of sediment (sand, silt, and fine particles) carried by a stream or river.

Sediment - Material suspended in or settling to the bottom of a liquid. Sediment input comes from natural sources, such as soil erosion, rock weathering, agricultural practices, or construction activities.

Seismicity - The likelihood of an area being subject to earthquakes; the phenomenon of earth movements.

Short-Term Effects - Short term effects are defined under the Independence Range Cumulative Effects Analysis (CEA) process as those effects that would not last longer than the life of the project. As an example, the loss of vegetation from the construction of a drill road would be a short-term effect because the road would be reclaimed and vegetation re-established following completion of the project. Other short-term effects, as defined in the CEA, are revegetated areas such as waste rock dump slopes, facility areas and pit backfills.

Significant - As used in NEPA determination of significance requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts (40 CFR 1508.27).

Soil - Loose, unconsolidated surface material including the A and E horizon (topsoil) and B horizon (subsoil).

Sub-grade - Ore from which minerals cannot be extracted profitably with existing technology and under present economic conditions.

Threatened Species - Any species of plant or animal which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Total Dissolved Solids (TDS) - Total amount of dissolved material, organic or inorganic, contained in a sample of water.

Total Suspended Particulates (TSP) - Particulates less than 100 microns in diameter suspended in a liquid sample.

Total Suspended Solids (TSS) - Amount of undissolved particles suspended in liquid.

Visual Quality Objective (VQO) - A desired level of excellence based on physical and sociological characteristics of an area. Refers to degree of acceptable alteration of the characteristic landscape.

Visual Resource - The composite of basic terrain, geologic features, water features, vegetation patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for viewers.

Waste Dump - Location and/or destination of waste, spoil, or overburden material removed during the mining operation to expose the orebody, but not including the marketable mineral, subsoil and topsoil.

Waste Rock - Non-ore rock that is extracted to gain access to ore. It contains no ore metals or ore metals at levels below the economic cutoff value, and must be removed to recover the ore.

Waters of the United States - A jurisdictional term from Section 404 of the Clean Water Act referring to waterbodies such as lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce.

Watershed - The geographic region from which water drains into a particular stream, river or body of water. A watershed includes hills, lowlands, and the body of water into which the land drains. Watershed boundaries are defined by the ridges or divides separating watersheds.

Wetlands - Areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

Wilderness - Land designated by Congress as a component of the National Wilderness Preservation System.

ABBREVIATIONS

AMSL . . . . . Above Mean Sea Level
AUM . . . . . Animal Unit Months
BLM . . . . . United States Department of the Interior Bureau of Land Management
°C . . . . . Degrees Centigrade
CFR . . . . . Code of Federal Regulation
cfs . . . . . Cubic Feet Per Second
Corps . . . . . United States Army Corps of Engineers
DEIS . . . . . Draft Environmental Impact Statement
EIS . . . . . Environmental Impact Statement
°F . . . . . Degrees Fahrenheit
EPA . . . . . United States Environmental Protection Agency
ESA . . . . . Endangered Species Act
FEIS . . . . . Final Environmental Impact Statement
FEMA . . . . . Federal Emergency Management Agency
FT . . . . . Feet or Foot
gpm . . . . . Gallons Per Minute
HAPs . . . . . Hazardous Air Pollutants
MDBM . . . . . Mount Diablo Meridian
mg/L . . . . . Milligrams per Liter
NAC . . . . . Nevada Administrative Code
NDEP . . . . . Nevada Division of Environmental Protection
NDOM . . . . . Nevada Division of Minerals
NDOT . . . . . Nevada Department of Transportation
NDOW . . . . . Nevada Division of Wildlife
NEPA . . . . . National Environmental Policy Act
NPDES . . . . . National Pollutant Discharge Elimination System
NRHP . . . . . National Register of Historic Places
PAG . . . . . Potentially Acid-Generating
PM_{10} . . . . . Particulate Matter less than ten microns
QA/QC . . . . . Quality Assurance/Quality Control
ROD . . . . . Record of Decision
SOAPA . . . . . South Operations Area Project Amendment
SHPO . . . . . State Historic Preservation Office
SPCCP . . . . . Spill Prevention Control and Countermeasure Plan
TCP . . . . . Traditional Cultural Properties
TDS . . . . . Total Dissolved Solids
TECS . . . . . Threatened, Endangered, Candidate and Sensitive
tpd . . . . . Tons per Day
TSP . . . . . Total Suspended Particulate
TSS . . . . . Total Suspended Solids
µg/L . . . . . Microgram per Liter
USFWS . . . . . United States Fish and Wildlife Service
USGS . . . . . United States Geological Survey
WAD . . . . . Weak Acid Dissociable
WRDF . . . . . Waste Rock Disposal Facility

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